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NOVEMBER 4, 1960

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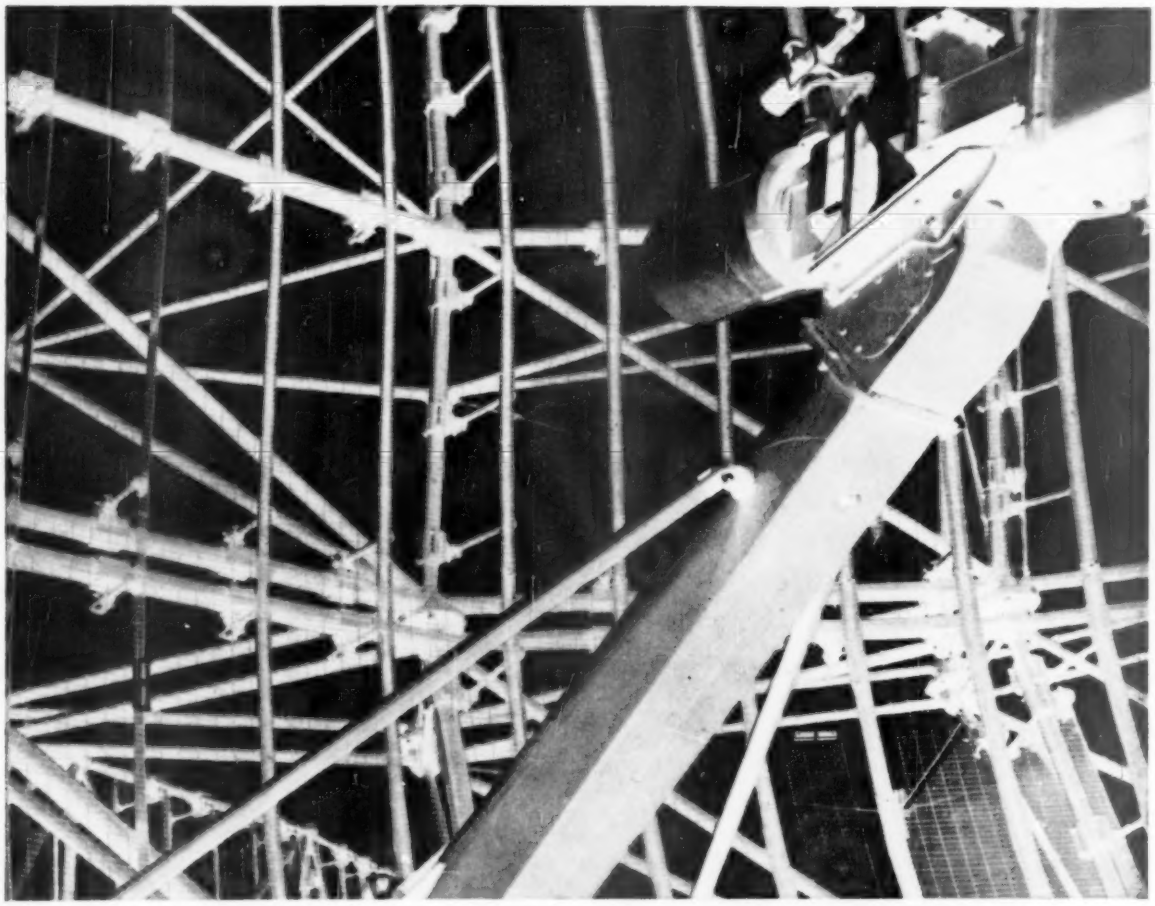

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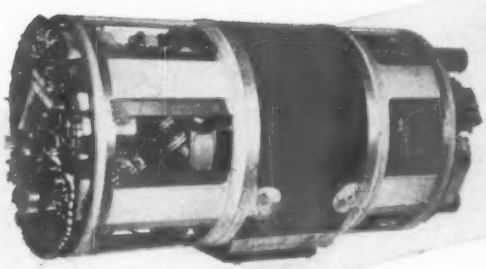

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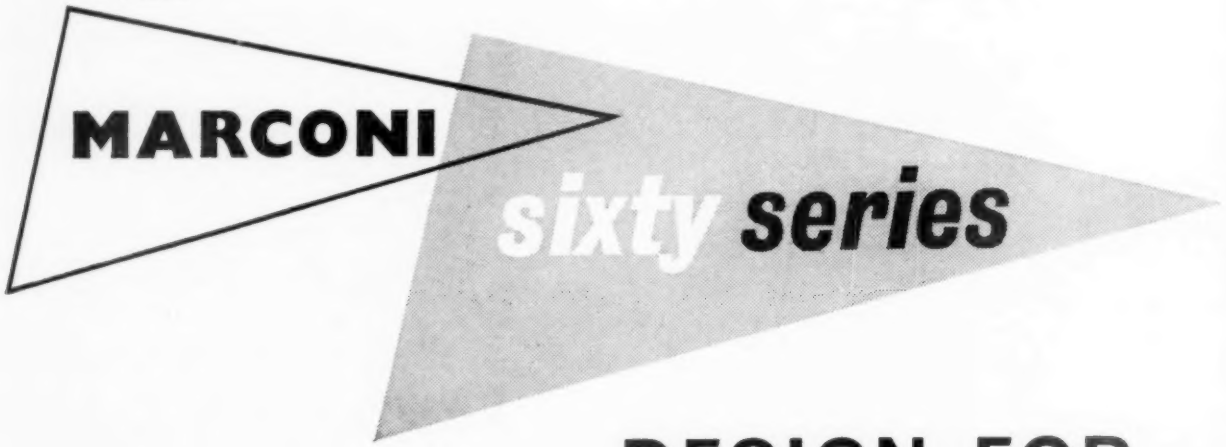

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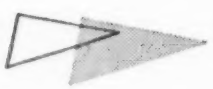
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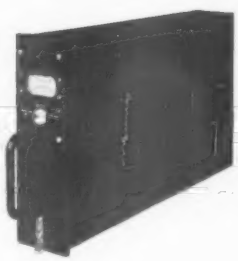

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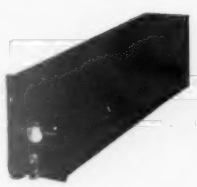

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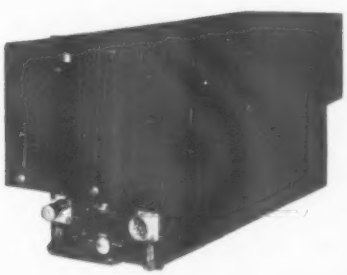

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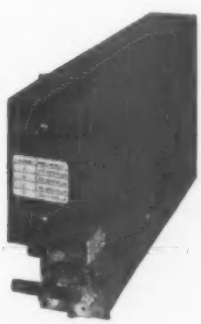

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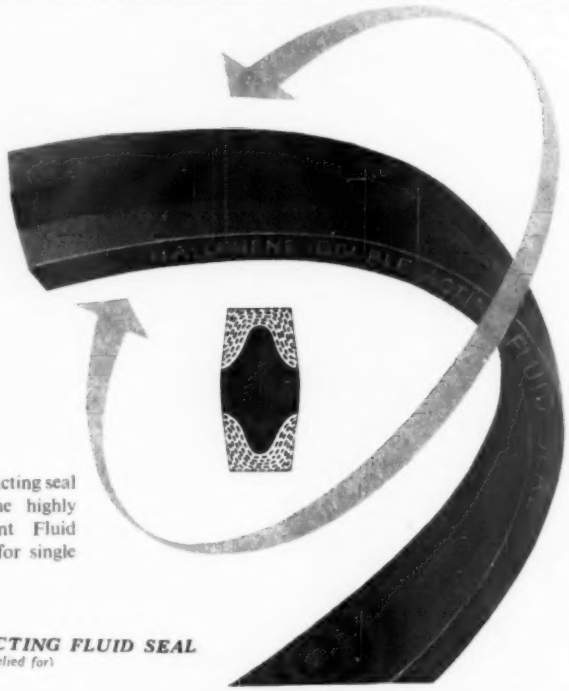

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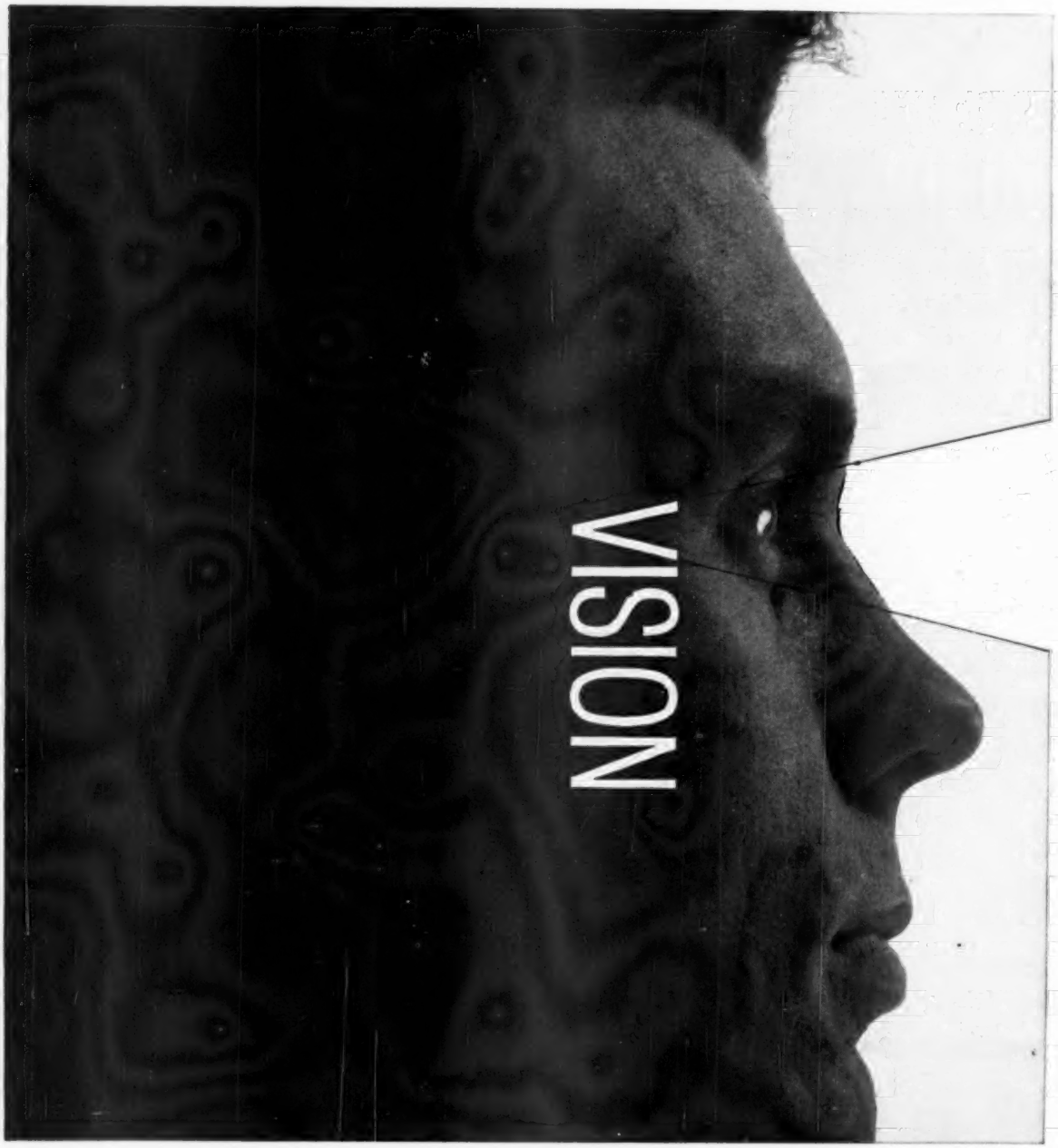

Imagine a man born today with fully developed faculties. He comes into the world and sees for the first time things of the world. He sees a cigarette. He has no idea of its purpose or value. He stands in the street and sees a million things—but he sees nothing but colours and shapes. To have meaning sight must be coupled with knowledge. At Fairey there are men with true vision, Hydraulics engineers who not only look at a problem but into it, through and beyond it to the solution. These are the men who create hydraulic systems for factories, aeroplanes, ships and nuclear power stations. They are working today for better living tomorrow.

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THE AEROPLANE and ASTRONAUTICS

VOLUME 99 NUMBER 2559 NOVEMBER 4, 1960

Ruling out Air Collision Risks

Among the hazards of flying which occupy a prominent place in the public mind is that of collision in the air. Incidents have been far too numerous lately for the quotation of statistics to do much good. There may have been fewer fatal air collisions than other types of fatal aircraft accidents but none the less it is an eventuality which people understandably worry about.

No wonder then that the public were so disturbed by the news that the Comet of R.A.F. Transport Command conveying Her Majesty the Queen home from Denmark had been "buzzed" by military aircraft. The impossibility of establishing "Purple Airways" outside the airspace of the United Kingdom makes it essential, in our view, that Her Majesty should only be carried in specially identified aircraft.

The incident once again emphasizes the need to unify civilian and military air traffic control; at least in so far as the airways are concerned. The eminence of those who on this occasion were so fortunately not even subjected to shock, must intensify attacks on the problem by the Ministry of Aviation and by the Air Ministry.

Supersonic Airliners to the Fore

No official reference was made to any discussion by Mr. Peter Thorneycroft during his visit to France last week with the authorities in that country on possible collaboration between the two countries over the design and construction of a supersonic airliner. On the other hand, it would certainly seem to have been an obvious thing to do. Sud and Dassault have jointly announced their interest in building the Super Caravelle to a supersonic specification. In this country Hawker Siddeley and B.A.C., Ltd., each submitted proposals to the Government some time back. It was announced last week that a study contract had been awarded to B.A.C., Ltd. At the end of the week Sir George Edwards made a strong plea for joint U.S./U.K. action in building the supersonic airliner.

It is thus timely that we are able to publish in this issue, and for the first time in this country, an exclusive study of the American proposals for the Mach-3 Valkyrie bomber, the B-70. This, it is to be noted, is one-third as fast again as the airliner which Sir George Edwards considers the World needs.

In the middle of October an eminent American engineer read a paper before the I.A.S. in Dallas setting forth the present situation with regard to the supersonic transport. According to the author of this paper, Mr. R. J. Patton, less than 500 hours' total flying have been accumulated so far in flying at Mach 2. In consequence there is very little realistic experience available for laying down a design for the supersonic transport.

He points out that the B-70 programme has obvious possibilities as a means of entering the supersonic transport business. Moreover, North American, the designers of the B-70, have a scheme for producing a transport modification of the B-70 by late 1963; a more extensive modification for military service as a personnel-cargo aeroplane could be available by 1966.

It is clear that the existence of the B-70 programme puts the Americans in a position of great advantage as regards collaboration for a joint effort. It might be well worth while therefore to follow up the situation with the French. Any collaborative effort with them could mean the adoption of British power plants.

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Matters of Moment

Change at the Air Ministry

AT the end of last week, Ministerial changes at Westminster made headline news. Principal among them was the resignation of the Hon. George Ward as Secretary of State for Air and the appointment of Mr. Julian Amery as his successor.

Mr. Ward, who had been Air Minister since 1957, had resigned in order to concentrate his energies in the world of business. His valuable services at the Air Ministry—to which he was no newcomer, having been Parliamentary Under-Secretary of State for Air from 1952 to 1955—and at the Admiralty, where he was Parliamentary and Financial Secretary in 1956, have been recognized by the award of a Viscountcy. No news has been forthcoming regarding details of his future plans; but the world of aviation will certainly be the loser, if they should have no aeronautical connections.

Mr. Amery, who has been Parliamentary Under-Secretary of State for the Colonial Office since 1958, comes to the Air Ministry as a newcomer to air affairs, but with a distinguished parliamentary and military record. Born in 1919, he was educated at Summerfields, Eton and Balliol College, Oxford. After a spell as war correspondent in the Spanish Civil War from 1938 to 1939, he was appointed an Attaché at the British Legation in Belgrade, and was engaged on special missions in Bulgaria, Turkey, Rumania and the Middle East in 1939 and 1940. He then joined the R.A.F. as a sergeant, was commissioned and transferred to the Army in 1941.

From 1941 to 1942 he saw active service in Egypt, Palestine and the Adriatic, and in 1944 became liaison officer to the Albanian resistance movement. In 1945 Mr. Amery served on the staff of Gen. Carton de Wiart, V.C., Mr. Churchill's personal representative with Generalissimo Chiang Kai-Shek. He was a delegate to the Consultative Assembly of the Council of Europe from 1950 to 1953 and in 1956, and was a member of the Round Table Conference on Malta in 1955. He was appointed Parliamentary Under-Secretary of State and Financial Secretary to the War Office in 1957; and in 1958 he went to the Colonial Office.

Mr. Julian Amery who succeeds Mr. George Ward as Secretary of State for Air.

Britain's Supersonic Airliner

IT has long been an open secret that the most likely contender for a contract to take the next steps towards the development of a British supersonic airliner, was the new British Aircraft Corporation. And last week in a written reply to a question in the House of Commons, came the long-awaited confirmation from the Minister of Aviation. (See page 608.)

Sir Arthur V. Harvey had asked if the Minister would "make a statement on the outcome of the discussions between his Department and the companies concerned on a supersonic airliner." To this, Mr. Thorneycroft replied:—

"As a result of those discussions the Government have now selected the British Aircraft Corporation to undertake further work on a limited design study contract for a possible supersonic airliner project. A contract for this work is being negotiated with the Corporation. It will cover a period of about a year and cost £350,000.

"If such an aircraft were to be built there would be substantial advantages in carrying it out in co-operation with other countries. The British Aircraft Corporation is being asked as part of the contract to explore further with appropriate companies overseas the possibilities of collaboration with a view to the sharing of costs and the widening of the market for the product."

Measuring Aircraft Noise

A COMMON method of measuring aircraft noise has been agreed by an international group of experts under the ægis of the European Productivity Agency of the O.E.E.C. The countries represented were Denmark, Germany, Italy, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States. France sent an observer. For the time being the group will work on the Perceived Noise Level.

MR. H. B. IRVING has written to say the statement by O.E.E.C. that agreement on a common method of measuring aircraft noise has been reached internationally is very greatly to be welcomed and it is much to be hoped that the various countries concerned will now go ahead and put the agreement into force, at the same time adopting means to relate measurements of Perceived Noise Level with public reaction to the noise.

The start of the discussions which eventually gave rise to the present agreement goes back to as far as March, 1957 when O.E.E.C. ran a five-day International Conference at Leyden, Holland, attended by all the countries mentioned in the present statement on "Fitting the job to the worker." Mr. Irving was one of the U.K. representatives at this Conference with the special capacity of "rapporteur" on noise.

There was a whole day's discussion on the question of noise generally, including industrial as well as aircraft noise, and special attention was drawn to the many and varied ways of arriving at a measure of subjective noise level; phons, dinphons, sons, etc. Eventually it was recommended that something should be done to come to agreement on a common method of arriving at subjective noise level from the usual objective noise measurements in decibels with the present happy, but somewhat belated, result.

The intervening time, however, has not been entirely lost, as in the meantime Bolt, Beranek and Newman have produced their well-thought-out and factually based scheme for arriving at what they call the Perceived Noise Level (PNdb). Although by no means the last word on the subject, it has been generally agreed in this country that the method of obtaining a satisfactory means of calculating subjective noise level from the objective decibel measurements usually taken by converting them to PNdbs is the most satisfactory method so far proposed.

This, at any rate, is the case so far as aircraft noise is concerned; it may be quite another so far as other types of noise are concerned. A lot of further information will need to be obtained and much discussion will be required before anything better is forthcoming.

Space-age Struggles

FRENCH officials are reported to have expressed interest in the project for a Euro-Commonwealth space-programme. Mr. Peter Thorneycroft, Minister of Aviation, returned to London on Oct. 29 after three days of confidential talks on the subject with Mr. Debré, Prime Minister, M. Guillaumat, Minister of State in charge of atomic affairs and rockets, M. Messmer, Defence Minister, and M. Buron, Minister for Civil Aviation.

Although no immediate statement was issued on the outcome, the French are believed to favour such a consortium in view of their preoccupation with an independent nuclear striking force. The cost involved in this would leave little over to spend on establishing a national space-programme. Thus, the British proposal might be welcomed as a means of France "getting into space" with the minimum additional expenditure. It remains to be seen what conditions the French may wish to impose if the venture materializes, but it is unlikely that they would expect to build rocket hardware for the initial satellite launcher which—for the sake of expediency alone—is likely to depend on Blue Streak and Black Knight.

Meanwhile, another factor has entered the field of speculation in the shape of the proposal by the American Telephone and Telegraph Company to undertake the development of a network of communication satellites in co-operation with Britain, France and Western Germany. Plans to this effect were announced by A.T. and T. on Oct. 21 as we reported last week.

If support for this proposal is forthcoming, it could seriously jeopardize the future of Blue Streak as a satellite launcher and the economical satellite system proposed by the Hawker Siddeley Group. The problem is complicated by the fact that A.T. and T. and the G.P.O. are joint owners of the trans-atlantic cable service and that radio-frequencies available for communications satellites are severely limited.

Talks now being held in the United States between representatives of the G.P.O., the Ministries of Aviation, Defence

and Science, and the Admiralty, and various agencies in the United States including private industry, are believed to be concerned with the problems of joint ownership of satellites, their radio frequencies, and the methods by which they may be operated. There can be little doubt, too, that American companies will be pressing their own proposals in order to gain both financial support from Europe to develop a prototype communications link and for establishment of ground stations.

Interim system: Provision of 600 voice circuits between Honolulu, the U.S. and Western Europe.	
Orbital height	3,000 miles
Satellite weight	175 lb.
Satellite size	48 in. dia.
Power supply	Solar cells and chemical batteries
Number of satellites	30 in random polar orbits
Number of voice channels	600
Number of R/T ground stations	8
Total cost estimated	$50 million
Global system:	
Number of satellites	50 in random polar orbits
Number of voice channels	600
Number of TV channels	1
Number of R/T ground stations	26
Operational life, satellite	10 years
Total cost estimated	$165 million; $115 million (voice circuits only)
Cost per ground station	$2.5 million

Proposed A.T. and T. system of communications satellites.

A.T. & T., incorporating the Bell Telephone System, have said they are willing to spend $50 million of their own money in establishing an interim network of 30 communications satellites; further details are outlined in the table.

Hawker Siddeley have not been asked by the Government to quote for the development of a British communications satellite despite the original character of their work and the fact that only three satellites pursuing elliptical orbits in 63° equatorial "slots" would be required for global operation. The system is specially tailored to the Blue Streak/Black Knight.

It would be interesting to know whether French reactions to the proposed western international communications scheme were sought.

Anglo-American Engines

ROLLS-ROYCE, LTD., and the Continental Motors Corporation of Muskegon, Michigan, U.S.A., have signed a licence agreement covering the full range of Continental aircraft piston engines. Under this the British company will supply engines and spare parts and will provide full after-sales service. The licence gives Rolls-Royce exclusive rights for all Continental piston engines and spares in Europe and for the manufacture of Continental engines in Australia and New Zealand.

According to the statement issued from Derby, Rolls-Royce will produce any of the Continental range for which a sufficient market is foreseen in the assigned territories. Early delivery of Continental-built engines through Rolls-Royce will be possible while production in Britain is being established. British-made parts and engines will be incorporated into the delivery programme as they become available.

All parts manufactured by the British company will be fully interchangeable with those from the U.S.A.

Manufacturing activities associated with the project will be at the Rolls-Royce Crewe factory and the company will set up a network of distributors for these engines. Service, spares and overhaul facilities will also be established.

Mr. J. P. Herriot has been appointed general manager of the newly formed Light Aircraft Engine Department. He joined Rolls-Royce in 1945 as chief development engineer on the early Whittle jet engines and was for several years manager of the Rolls-Royce licence department. For the past two years he has been responsible for World-wide market research on the future of light aircraft with particular reference to engines.

Continental engines are air-cooled horizontally opposed four- and six-cylinder types, ranging in power from 65 b.h.p. to 400 b.h.p. They are installed in a wide variety of personal, touring and business aircraft in many countries, and also have military applications. Continental will continue to expand its design of aircraft engines and provisions are made in the licence agreement to include future engine developments by Continental.

Following the statement by Rolls-Royce, British Executive and General Aviation, Ltd. (Beagle), stated that they had completed arrangements with Rolls-Royce for the supply of a range of new Rolls-Royce/Continental powerplants. These will be installed in the Beagle Executive and Auster/Beagle aircraft now being developed.

By signing this agreement with Continental, Rolls-Royce has made a move which should greatly help overseas sales of future British executive aircraft. In addition to the Beagle Executive, the Short Skyvan is another new British aircraft which should benefit. Rolls-Royce might also supply Continental engines for U.S. aircraft imported into Europe, Australia and New Zealand. In addition, certain Continental-powered aircraft are built by European manufacturers.

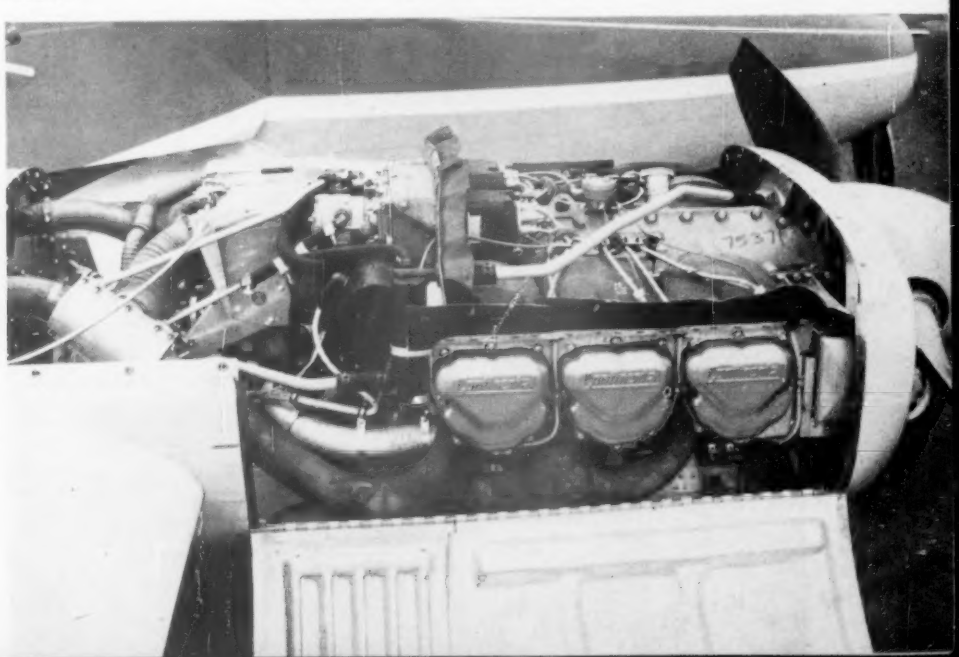
Three Quarters' Exports

ALTHOUGH the aircraft industry's September export income was £250,000 higher than that for the corresponding month last year, the annual rate of income based on the figures for the first nine months of the year show a drop in comparison with the 1959 total. In fact, with the September export income of £9,904,191 making a grand total for 1960 to date of £108,283,371, the annual rate works out at £145 million. The 1959 total export income was £156 million.

Once again, however, the aero-engine industry has maintained its reputation for setting new export records. The nine-month aero-engine total of £54,928,732 is well above every annual aero-engine total export figure—with the exception of the £64.5m. recorded for 1959.

Totals for the July-September quarter this year are: £31,842,692 grand total (it was £33,403,802 in 1959) comprising £13,414,066 for aircraft and parts (£15,060,819 in 1959), and £16,877,969 for aero-engines and parts (£16,580,800 in 1959).

September's export income was made up of: aircraft, £3,133,714; aircraft parts £1,523,310; new aero-engines, £1,906,504; "other than new" aero-engines, £1,691,627; aero-engine parts, £1,267,916; electrical appliances, £202,551; tyres, £64,390; and instruments, £114,179.



ROLLS-ROYCE CONTINENTALS.—Mr. J. P. Herriot (above), is general manager of the Rolls-Royce light aircraft engine department which will produce Continental piston engines under licence. A typical Continental which might power new British aircraft such as the Beagle Executive is the 260-b.h.p. IO-470-D (right).

The Royal Comet's "Near Miss" over Holland

ON Oct. 25 Her Majesty the Queen and His Royal Highness the Prince Philip, Duke of Edinburgh, were returning to London in a Comet of R.A.F. Transport Command after a private visit to the King and Queen of Denmark. While still airborne the captain of the aircraft, Sqn. Ldr. Peter Pullan, reported a "near miss" to Amsterdam air traffic control.

The incident was reported to have taken place at a height of 30,000 ft., approximately 20 miles north-east of Eelde, Holland, near the German-Dutch border. Flying "airways" from Kastrup Airport, Copenhagen, to London Airport, the aircraft, Comet XK696 of No. 216 Squadron, was within the Hannover flight information region (F.I.R.) at the time.

On landing at London Airport the crew were interviewed by the Press and from the available information it appears that two Sabres flying in close formation as a "pair" turned in from above and in front of the Comet, making a collision course pass over the top of the aircraft. The only member of the crew to see the two fighters was the co-pilot, Flt. Lt. F. J. Stevens, who is reported to have stated that "they had damn great iron crosses under their wings"—the symbol of the West German Air Force.

The Comet was stated to have been on course and on time, and under 2nd A.T.A.F. radar surveillance when the incident took place. Although it happened within the Hannover F.I.R., it was reported to Amsterdam control as that was the next F.I.R. the aircraft was to fly through. The Dutch had no contact with the Sabres.

Within the United Kingdom F.I.R.s, Royal flights are made known in advance to all the concerned military and civil authorities by means of a special class one NOTAM. This specifies the route, times at reporting points, operational height band and any special A.T.C. procedures that are to be observed for specified periods during the flight. Whenever possible Royal flights are conducted within existing controlled airspace, but when this is not possible, temporary airways are established.

These and the selected height bands within national U.K. airways are known as "Purple Airways." Established 15 min. before the Royal aircraft is scheduled to enter until 30 min. after it is scheduled to leave, Purple Airways outside of controlled airspace are normally five n. miles wide and extend vertically from 2,000 ft. to a given flight level.

Outside the United Kingdom, the responsibility for the notification of a proposed Royal flight in a military aircraft is divided between the operator, in this case Transport Command, and the M.o.A. Aeronautical Information Service at Pinner. Transport Command signal details of the flight plan to all the necessary military A.T.C. Centres overseas and A.I.S. notify the civil A.T.C.C.s by means of its U.K. NOTAM. Such a NOTAM does not give detailed information regarding the flight outside the airspace control by the country issuing it.

For example, the main details in the NOTAM regarding the Royal flight issued on Oct. 18 were:—

	ETD	*ETA*
Copenhagen (Kastrup)	10.10	
London F.I.R. boundary at 5206N 0230E		11.32
Clacton VOR		11.43
Brookmans Park NDB		11.54
Watford NDB		11.57
as directed to London Airport		12.05

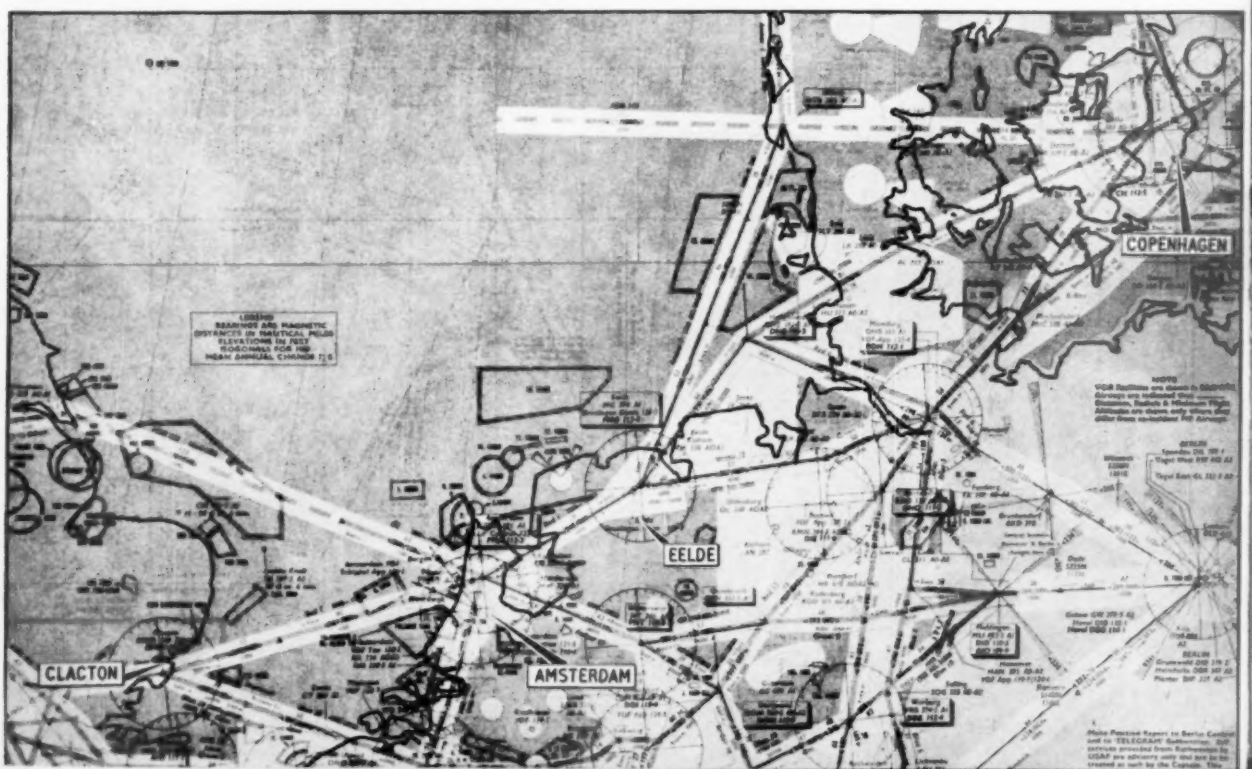
It is to be noted that the aircraft in which Her Majesty was travelling was in standard R.A.F. Transport Command markings. Compared with the Comets of R.A.F. Transport Command, aircraft of the Queen's Flight are distinctively coloured. The Flight's Herons, for example, have an all-over fluorescent red finish with the exception of a royal blue or Edinburgh green strip down the sides of the fuselage between the windows, the engine cowlings, and the top of the nose in front of the cockpit windscreen.

The Anglo-German commission of inquiry investigating the incident concluded its inquiries during the week-end. Completion of its report was expected on Oct. 31.

From the published information and from our own inquiries it seems quite clear that the special safety arrangements covered by the phrase "Purple Airway" only apply in their entirety to the airspace controlled by the U.K. Outside that space the air traffic control authorities will obviously do all that they can to ensure clear passage for Royal aircraft within the normal procedures.

On the other hand the links between military and civil air traffic control have never been regarded as satisfactory. Moreover, it is often normal practice for fighters to make use of the military aircraft of friendly powers as targets for tactical manœuvres. With new air forces being trained in the NATO countries an obvious complication in the preparations for a Royal flight must be the advising of all crews likely to be airborne that one particular Comet of the R.A.F., only distinguished, we understand, in this case by a registration number, is carrying the Queen of England.

As reported above, and as it is only reasonable to expect, the Comet was under radar surveillance from the appropriate military air traffic control radars. But presumably a watch



AIR TRAFFIC PROBLEM.—A reproduction of part of the Aeradio map for the North Sea area showing the airways (in white) and the various controls. The original is coloured which aids interpretation. "Red One" is the airway running down from Copenhagen through Hannover and Amsterdam to Clacton.

Photograph copyright "The Aeroplane and Astronautics"

IDENTICAL TWIN.—A Comet of R.A.F. Transport Command exactly similar as regards markings with that in which Her Majesty was travelling at the time of the incident.

of this kind would only serve as a check on the progress of the Comet and on the relative position of other aircraft using the same airway.

Special organization would be needed to look out for military aircraft outside the airway which might suddenly decide to fly over and have a look. In such circumstances the control could only issue a warning to the crew of the Comet; it might not prove feasible to establish radio contact with the pilots of the intruding aircraft.

In the old days when sovereigns put to sea, the battleship in which the Royal party travelled would be distinguished by special paintwork. Moreover, there would be escorting warships.

Escorts in the air would be effective only in VFR conditions. But equally it is in such conditions that passes might be made at a military machine not otherwise distinguished. For this, if no other reason, aircraft carrying the Queen should be readily identifiable.

Co-operative Action for the Supersonic Airliner

THE strongest possible plea for joint action by the Governments of the United States and of this country with regard to the building of the supersonic airliner was put forward by Sir George Edwards last week. He was one of several speakers at the Annual Conference of the Institute of Directors. He gave his talk before the announcement, though no doubt fully aware of the fact, of the Government's decision to place a study contract for the supersonic airliner with B.A.C., Ltd.

Sir George Edwards also expressed strong views about the folly of allowing ourselves, or of the Americans allowing themselves, to be deflected from following the policy thought to be right in order to surpass the Russians. We, in the West, should back our own judgment in this matter.

Earlier in his talk Sir George had warned that if the Russians decided that they wanted to make an all-out attack on the economy and substance of the airlines and aircraft manufacturing industries of the West, then easily the cheapest way in which they could really bring chaos to both would be to produce a so-called supersonic transport flying at an alleged 2,000 m.p.h. If we fell for this one, and got ourselves into what Sir George described as a Sputnik panic, then he thought we should deserve everything that happened to us.

Sir George said that in the first instance the Governments of America and this country should get together, agree on the principle of co-operation and establish the cruising speed of the aircraft at 1,500 m.p.h. The manufacturing industries, in the train of this agreement, would then get to grips with the problem on a co-operative basis and the airlines themselves would have to agree that a 1,500-m.p.h. transport, introduced in the early 1970s, is as much as any of them can manage and that no one will break away with anything faster or sooner. Unless some such arrangement were come to Sir George feared that grave problems lay ahead for manufacturers and operators alike.

In order to show the need for Government support in developing new civil aircraft Sir George had quoted figures showing how deeply the American industry had had to dip into their pockets in this connection. The leading American aircraft companies are blessed with Government contracts far greater than anything seen in this country and most of them have a civil aircraft turnover which is little more than 20% of their total; but with all these advantages they have been having a very painful time.

The great Boeing Company; Douglas—the greatest name in civil aviation; General Dynamics, which only have an interest in aircraft through two subsidiary companies; and Lockheed—all these have shown heavy losses on their civil aircraft currently in production. It is a sobering thought that between them these four big companies have written off over £200 millions on their current civil aeroplanes, and three of these Big Four have declared losses on their 1960 operations to date.

That they were able to write off this enormous sum and still stay in business was, of course, only made possible by their massive Government programmes. It is, therefore, not surprising that the British aircraft industry should need some Government support. In Sir George's opinion, the American aircraft industry will have to go through mergers similar to those through which we have just passed in this country. They generally do things two or three years after we do.

He also begged directors to boycott Mach-3 speeds. "Take my advice and don't fall for it. If you say you are not going to buy a ticket on anything faster than 1,500 m.p.h. for the next 20 years you will be acting in the best interests of the airlines, the aeroplane manufacturing industry and your own physical well-being."

Glider Accident Explained

AT the inquest on Oct. 27 on the instructor and pupil who were killed at Dunstable Downs on Sept. 30 when a two-seater sailplane dived in from 500 ft., the almost certain explanation of the accident was revealed. Dr. E. E. Smith, of Epsom, gave evidence that he had treated John Westhorpe, the instructor, for epilepsy since 1952, and that his last known attack had been "a minor one" five years earlier.

Technically, "minor epilepsy," known medically as "petit mal," is a form in which there are no convulsions but the sufferer is, for a time, not conscious of what he is doing; however, it is not clear which form Westhorpe suffered from. Since the glider had already been doing stalls, dives and recoveries, the pupil, though he had already had five days' instruction, might not have realized what was happening during the last dive until it was too late to take any action. In case of a convulsion, the control stick would be gripped tightly and it might be impossible to loosen the pilot's hold.

Neither Westhorpe's father nor anyone at the London Gliding Club knew he was an epileptic; in fact, he had answered "no" to the question on epilepsy when signing the form of application for entry to the club.

Recently John Westhorpe had learned to fly aeroplanes and this year obtained his Private Pilot's Licence, which entails a medical examination. But there appears no certain way of detecting an epileptic subject in the intervals between attacks. An electroencephalogram, which records "brain waves," shows a characteristic abnormality in many epileptic cases, but not in all, while the same abnormality sometimes occurs in non-epileptic people.—A.E.S.

Aviation News in General

HISTORICAL LECTURE. — "My First Ten Years in Aviation" is the title of the lecture which Sir Thomas Sopwith will read before the historical group of the Royal Aeronautical Society on Monday, Nov. 21. The lecture will be given at 6 p.m. at the Institution of Mechanical Engineers, Birdcage Walk, S.W.1.

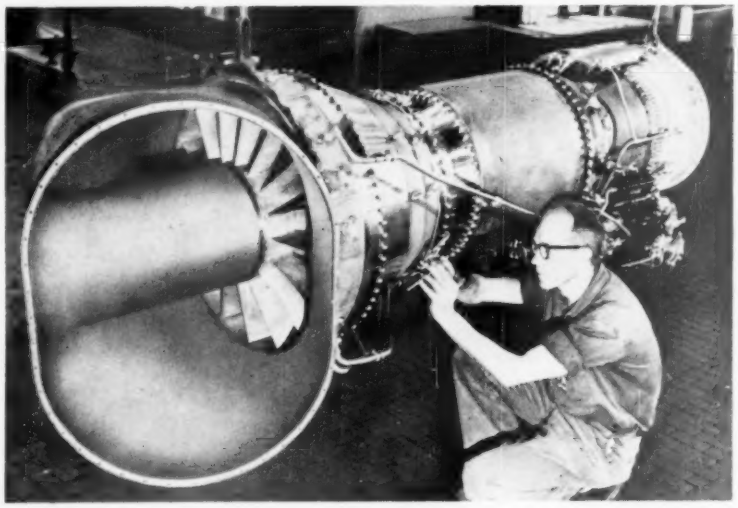
HELICOPTER ORDER.—A $21m. production contract for Navy HU2K Seasprite utility helicopters has been awarded to the Kaman Aircraft Corpn. by the U.S. Bureau of Naval Weapons. The contract calls for production and fleet delivery of Seasprites to begin in 1962. The HU2K is a single-rotor helicopter powered by a 1,250-s.h.p. General Electric T-58 turbine engine.

MIRAGE PRODUCTION.—The first production Dassault Mirage 3 interceptor made its maiden flight at Mérignac on Oct. 9, exactly 24 months after the French Government placed an order for production aircraft.

AUSTRALIAN MERGER. — The Australian company, Pye Industries Ltd., and Petbow Ltd., of Sandwich, have formed a joint Australian company—Petbow Pty. Ltd. The plant in Australia will gradually extend its operation to cover the whole Petbow range of engine-driven power plant which includes welding and generating equipment. It will also manufacture Magnicon Alternators under licence to the Macfarlane Engineering Co., Ltd., Scotland.

RALLYE ORDERS. — Following demonstrations by the Morane-Saulnier 880 Rallye, firm orders have been placed for about 100 of these three-seat tourer and training aircraft. By Oct. 15 orders for 72 had been received from France and 26 had been ordered by 14 other countries.

TUBE AGREEMENT.—Bristol Aerojet, Ltd., and Permali, Ltd., of Gloucester, have signed an agreement whereby the two companies will collaborate in the manufacture and selling of specialized tubular components. The agreement concerns tubular structures of helically wound glass-fibre rovings bonded with synthetic resin. Manufacture will be undertaken by Bristol Aerojet; selling will be undertaken by Permali; design and development will be a joint responsibility.



NEW TURBOSHAFT.—Developed from the JT 12 turbojet, the new Pratt & Whitney JFTD-12 free-turbine will develop 4,050 s.h.p. Two of these engines are to power the Sikorsky S-64 Skycrane helicopter. The engine weighs 870 lb.

AUSTRALIAN U-2s.—American U-2 and JB-57 aircraft based at East Sale, in Victoria, Australia, are making high-altitude flights over the ocean south of Australia for radiation and fall-out research. According to an Australian report the U-2s can fly for 7½ hr. at 70,000 ft.; they will go about 1,500 miles south of the Australian coast. On Oct. 25 three U-2s flew non-stop from Fiji to East Sale. Four JB-57s also arrived there the same day.

LONG-RANGE POLARIS. — The Lockheed Aircraft Corp. has been given a $181 million contract to accelerate development of a long-range version of the Polaris missile.

H.D.A. NEW NUMBER.—Telephone numbers of the High Duty Alloys, Ltd., Forging Division, are now: Redditch 4211 (day) and Redditch 4162 (night).

SATELLITE DETECTOR.—U.S. Defence Department is reported to be interested in a polar orbiting satellite system to work in conjunction with ground-based anti-missile missiles. Designated Project SPAD (Satellite Protection for Area Defense), object is to reduce warning time to intercepting batteries. Stationing of counter-weapons in orbit is also being studied.

SATURN LAUNCHING. — First Saturn launching—with dummy upper stages—is scheduled for June or July next year. Booster is now being assembled at the Marshall Space Flight Center and will take about five to six weeks to ship by barge from Huntsville, Alabama, to Cape Canaveral, in Florida.

STAGE FAILURE.—Failure of the first and second stages of a Thor-Agena B rocket to separate resulted in the loss of Discoverer XVI launched on Oct. 26 from Vandenberg A.F.B.

POLARIS PATROL.—America's first Polaris submarine, the "George Washington," will be deployed at sea on Nov. 15. This was stated on Oct. 27 by Adml. Arleigh Burke, U.S. Chief of Naval Operations. The "George Washington" can launch 16 Polaris IRBMs; each carries a warhead of nearly one megaton and has a range of 1,200 naut. miles.

ETENDARD ON DECK.—Following the "dry" deck-landing trials of the Dassault Etendard IVM at R.A.E. Bedford earlier this year, the second pre-production example of this French naval fighter recently went on board the carrier "Clemenceau" for the first time. During its initial trials at sea, the Atar-powered Etendard completed an extensive programme of steam catapult launchings and arrested landings.

Commercial Aviation Affairs

CONVAIR ORDERS.—One Convair 880-M has been ordered by Alaska Airlines. The total of 94 Convair jet transports now on order includes, in addition to orders already announced, one 880-M for the F.A.A. and seven 880-Ms for an unidentified airline.

POOL WITH AEROFLOT.—B.E.A. has signed a revenue-pooling agreement with Aeroflot to take effect from May 1, 1961. On that date B.E.A. and Aeroflot will increase their London-Moscow services to three a week each and a rationalization of these services is being discussed to provide same-time departures six days a week.

707 CRASH-LANDING.—A South African Airways' Boeing 707-344 made a belly landing at Nairobi Airport, Embakasi, in the early morning of Oct. 30. There were 79 passengers and 12 crew on board; no one was seriously hurt. The 707 was on the Johannesburg-London service and had apparently suffered undercarriage (or hydraulic) trouble and had cruised around for an hour to burn off fuel before coming in to a belly landing.

J.A.L. EXPANSION.—Japan Air Lines introduced a non-stop DC-8 service between Tokyo and Hong Kong on Nov. 1 at a twice-weekly frequency. On Nov. 2 a Tokyo-Seattle service via Anchorage was opened, also using DC-8s.

END OF AN ERA.—On Oct. 31 B.E.A.'s DC-3 G-AGHS made the last Pionair scheduled passenger flight out of London Airport when it operated the Birmingham service. This DC-3 was rolled out on Aug. 20, 1943, and has logged 23,047 hours. At one time the Corporation had 50 DC-3s (1952); all B.E.A.'s trunk services will in future be operated by Viscounts or Comets. This final flight ended in misfortune; because of poor visibility G-AGHS overshot the runway at Elmdon.

AERADIO OPENING.—The new Dubai airport was opened by the Ruler of Dubai, on Sept. 30. Left to right: S. J. Hodge (I.A.L. general manager, Trucial Oman); Abdul Rahman (Arab assistant to I.A.L. general manager); The Ruler of Dubai, Sheikh Rashid Bin Said Al Maktoum; R. M. Parrack (I.A.L. airport manager, Dubai); and G. R. Stroud (I.A.L. head office). Below, the terminal building. (See also p. 612)

PARDON ME.—Capt. W. Beall described as "an honest to goodness mistake" his landing of a Pan American Boeing 707 at Northolt instead of London Airport on Oct. 25. The aircraft landed without difficulty on the 5,400-ft. runway with 41 passengers and later took off for London Airport without passengers.

CARAVELLE ORDER.—Iberia, the Spanish airline, has indicated its intention to order four Caravelle 6Rs with an option on a further four.

NOISE LAWSUIT.—The Port of New York Authority has requested the Supreme Court to "enjoin and restrain" Delta Air Lines from violating its regulations for the use of New York International Airport by jet aircraft. The lawsuit is the first of its kind and results from Delta having "repeatedly planned and conducted its jet flights in disregard of" the PNYA regulations. The Authority claimed that 26.2% of Delta's 841 jet flights between January and September, 1960, were in violation of the rules.

News About People

NEW LABORATORY.—The Minister of Aviation opened this new G.E.C. applied electronics laboratory at Portsmouth on Oct. 21. It is one of three operated by the company on behalf of M.o.A. for research and development on electronic equipment for defence purposes.

MASTER PILOTS.—GAPAN has awarded Master Air Pilots' certificates to Capt. H. R. Nicholls, senior pilot of B.O.A.C.'s Britannia 102 flight; and to Mr. H. E. Baker, Chief flying instructor and manager of the London Transport Flying Club since 1947.

BOARD APPOINTMENTS.—To fill vacancies on the board of B.O.A.C. Associated Companies the following have been appointed directors: Mr. B. W. Bampfylde (general manager, Eastern Routes, B.O.A.C.), Mr. K. W. Bevan (financial comptroller, B.O.A.C.), Mr. D. H. Glover (general manager, Southern Routes, B.O.A.C.), Mr. J. Linstead (general manager, B.O.A.C. Associated Companies) and Mr. J. R. Stainton (general manager, Western Routes, B.O.A.C.).

EXECUTIVE CHANGES.—Mr. R. G. Smith has become contracts manager of Nash and Thomson, Ltd. Mr. A. L. Lee has been appointed sales engineer for the Midlands and Northern England and is responsible for the sales of metallurgical, process control, survey and electronic equipment. Mr. D. H. Yates has joined the company as sales office manager; and Mr. A. Ward has been appointed chief inspector.

BIRFIELD NEWS.—Mr. C. G. T. Hyslop retired from the board of Birfield, Ltd., on Oct. 19, upon reaching his 70th birthday. He will continue to be chairman of three Birfield Group companies—The Phosphor Bronze Co., Ltd., Kent Alloys, Ltd., and R. Jones and Co., Ltd.

WOLF TOOLS APPOINTMENT.—Mr. D. F. Kershaw has been appointed by Wolf Electric Tools, Ltd., of London, to the post of general manager of their Canadian Branch. Mr. Kershaw has lived in Ontario for the past six years, where he has been closely associated with the machine tool industry. His headquarters will be the Wolf Branch, 93 Advance Road, Toronto 18, Ontario.

SURVEY COMPLETE.—Having completed his inquiry into civil aviation development in the West Indies, Sir Frederick Tymms arrived back in this country last week.

Air Transport

Supersonic Decision

BY placing a "limited design study contract" for a supersonic airliner with the British Aircraft Corporation, as announced by the Minister of Aviation on Oct. 27, the Government has indicated its policy towards this project for the immediate future. The size of the contract—£350,000 for a year's work—is adequate to keep design effort on the project going forward, but is sufficiently small to permit an ultimate decision against proceeding with construction to be taken fairly painlessly, if desired.

Choice of B.A.C. for this contract seems to indicate a Government preference for this group over Hawker Siddeley Aviation for the ultimate prime contract if it is ever placed. And the terms of the contract show that the Government is still anxious to bring in foreign interests as a means of spreading the costs and widening the market.

The design which is now to be developed is one of a series of studies originated in the Filton project office of Bristol Aircraft, Ltd., under the direction of Dr. A. E. Russell. Known as the Bristol 198, it is, we understand, a 120-seat narrow delta, designed to operate at Mach 2.3 over transatlantic ranges. Six engines are used, and these might well be advanced versions of the B.S. Olympus using cruise afterburning.

Placing of this contract is the latest move by the Government in developing a supersonic transport. Some of the more significant steps in this process are noted below:—

November 1956. Supersonic Transport Aircraft Committee set up to co-ordinate the ideas of the aircraft industry, the airline and the Ministry research establishments.

March 1959. The Minister reported receipt of the S.T.A.C. report, which suggested possible development of Mach 1.2 or Mach 2.2 airliners, and recommending a start on design work.

July 1959. The Minister announced that the S.T.A.C. report had been submitted to industry for its views, and that the industry favoured development of only the Mach 2.2 version.

September 1959. First mention was made of the HP115 slim delta research aircraft, ordered by the Ministry for slow-speed investigations of this plan form.

February 1960. The Government placed study contracts with the B.A.C., Hawker Siddeley, Bristol Siddeley Engines and Rolls-Royce for feasibility studies covering the technical issues, including optimum speed and economic prospects.

April 1960. The Minister held talks in Paris with the French Minister of Transport on the possibility of Anglo-French collaboration in developing a supersonic airliner. A week later, Sud-Aviation and Dassault announced they would collaborate in tendering, before the end of 1960, to an official specification, based on an Air France recommendation, for a supersonic airliner to carry 60-80 passengers 2,000 naut. miles.

September 1960. The U.S.A.F. confirmed its interest in a Mach 2.2 transport to carry 60,000-lb. payload 3,500 naut. miles. A specification would be written in conjunction with the F.A.A. to take account of commercial requirements.

October 1960. As further evidence of British interest in the highly swept narrow-delta layout, the Short SB5 was modified to have a wing sweep-back of 69° and began a new series of trials.

One certain consequence of the placing of the design study contract with B.A.C. will be increased agitation by the U.S. industry for Government backing for a similar project. The possibility that Russia or Britain might be first in the supersonic field has been consistently used as an argument for such support—although technical papers on supersonic transports presented in the past two years, make it clear that the American industry has already spent much more than £350,000 of its own money on research in this field, and Lockheed alone included an item of $2.5 million (nearly £1 million) for supersonic transport development costs in its 1959 balance sheet.

Vanguard Progress

BY the time this issue appears, Vickers should have completed the 200-hour "engine assurance" flight programme on the Vanguard which began on October 6. For this programme, Rolls-Royce supplied a set of fully modified Tyne engines, which have been installed in G-APED, "No. 4 B.E.A." (see our issue of Sept. 30). Flying six days a week, this Vanguard had totalled over 160 hours by Oct. 27, for an average daily utilization of a fraction over nine hours. In one 24-hr. period, 19½ hours were flown.

Flights have been made to a simulated airline pattern, the daily routine being a five-hour morning flight to represent a 1,550 naut. mile sector (say London-Istanbul); a 3-hour, 900-mile afternoon flight (say London-Rome); and a 1-hour, 250-mile flight (say London-Paris). The schedule called for 40-minute turn-rounds between flights.

On a typical afternoon flight last week, with a representative of THE AEROPLANE AND ASTRONAUTICS on board, the flight plan called for a 20,000-ft. cruise up and down the South Coast between Swanage and Dover; most flights have gone as far as Land's End, but on this day the rainclouds which brought disaster to Exeter shortened the westward leg. Modifications of the Tyne have made no difference to handling or performance of the engine; the take-off is made at 15,250 r.p.m., and the climb and cruise at a constant 12,500 r.p.m., with thrust varied by adjusting the fuel flow.

On this flight a straight climb was made to cruising altitude; on others, three-minute levels have been flown at 5,000 ft. and 10,000 ft. to simulate A.T.C. procedures. The cruising speed of 334 knots I.A.S. was a representative one for economical operation, although the T.C.A. Vanguard with Tyne 11s will have a maximum cruise speed of 369 knots. The descent was made at a steady 1,000 ft./min. with engines at 10,500 r.p.m.

Eleven Vanguards in all have now flown from Weybridge, and there is inevitably a bottleneck at Wisley until more engines are available, since the production flow of aircraft has never faltered. The certification programme for the T.C.A. Type 952 Vanguard has been continuing, however, using development Tynes which are unmodified but cleared by Rolls-Royce to a limit of 150 hours or 700 "slow cycles"—starts from cold to full power. These engines all have compressors which have exceeded by a safe margin the critical life period for failure attributable to faulty heat treatment.

Only one such failure—on a test bench—in fact occurred, and Vickers had experienced no trouble from this source in flight trials with eight Vanguards up to the grounding of the Tyne in May. Three examples of bearing failure had occurred in flight, however, and modifications have been introduced to correct this fault as well as that in the compressor. The modified Tyne is expected to enter service with a 200-hour overhaul life.

The T.C.A. Vanguard will be certificated by the A.R.B. for Canadian validation of the British C. of A. A total of 175 hours flying is scheduled, of which over 140 hours have now been completed. The present position of the 11 Vanguards flown is as follows:

G-AOYW. Vickers-owned prototype, now used for certification trials on the Collins autopilot and flight system for the T.C.A. aircraft. Flying with limited-life development engines.

G-APEA, 'PEB, 'PEC and 'PEF. B.E.A. Type 951s awaiting engines at Wisley.

G-APED. Completing 200-hour programme with modified engines, two of which will be returned to Rolls-Royce for strip.

G-APEE. Now being fitted with fully modified Tynes, to be submitted to A.R.B. for full Tyne Certificate of Airworthiness. Delivery to B.E.A., with G-APED, before end of November, for *ad hoc* services to Paris in December.

CF-TKA. Handling and performance trials, with development engines. Tropical trials in Africa early next spring.

CF-TKB. Air conditioning and general systems checks, with development engines.

CF-TKC. Awaiting engines at Wisley.

CF-TKD. On production tests with modified engines, to be submitted for C. of A. this month. Delivery in December for services in January, 1961.

Significant Helicopter

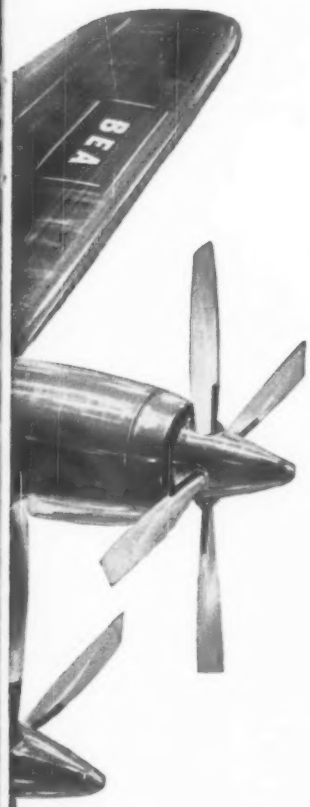
WHEN Mr. Robert Cummings, president of New York Airways, addressed the R.Ae.S. Rotorcraft Section early this year, he indicated that a fleet of Boeing-Vertol 107-II helicopters would allow profitable operations without subsidy by 1965-66. A prototype of this helicopter, which is thus of considerable significance, made its first flight on Oct. 25.

To make an early start on the F.A.A. flight tests, Vertol have converted this prototype from one of the three YHC-1As built for U.S. Army evaluation. Production helicopters for the Army based on this design will be larger, and are known as the HC-1B Chinook; the commercial 107-II is dimensionally similar to the YHC-1A but has a number of improvements.

A completely new transmission and new rotor system has been fitted, to allow an increase in total power from 1,700 h.p. to 2,300 h.p., and two 1,050 s.h.p. General Electric CT58-100 turbines have replaced the 850 s.h.p. T58-GE-6s originally fitted. The first 107-IIs for New York Airways (which has ordered 10) will have these -100 engines, but the 1,250 s.h.p. CT58-110 will become available later.

Other changes introduced on the 107-II are a new forward rotor pylon to improve directional stability, redesigned control system, changes to the electrical system and a 23-in. extension of the stub floats to improve water stability. These stubs contain the fuel tanks and together with the water-tight cabin give the 107-II its amphibious capability. Standard airline interior for the 107-II provides for 25 seats.

The longest queues are for the cheapest seats



People want to travel. They want to travel quickly. They want to travel cheaply.

Economy fares offered by airline operators have turned these requirements into record traffic figures. During 1959, 72% of all North Atlantic passengers flew 'Economy Class' and on U.S. domestic trunk lines Coach Class travel held a record share (43.6%) of the market. In Australia cheap fare travel has increased by 102%.

These results were obtained with existing aircraft. The Vickers Vanguard has been specifically designed to cater for mass air travel at low fares and presents airline operators with the finest opportunity of gaining an even more profitable share of this great expanding market.

The cheapest seats are in the

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

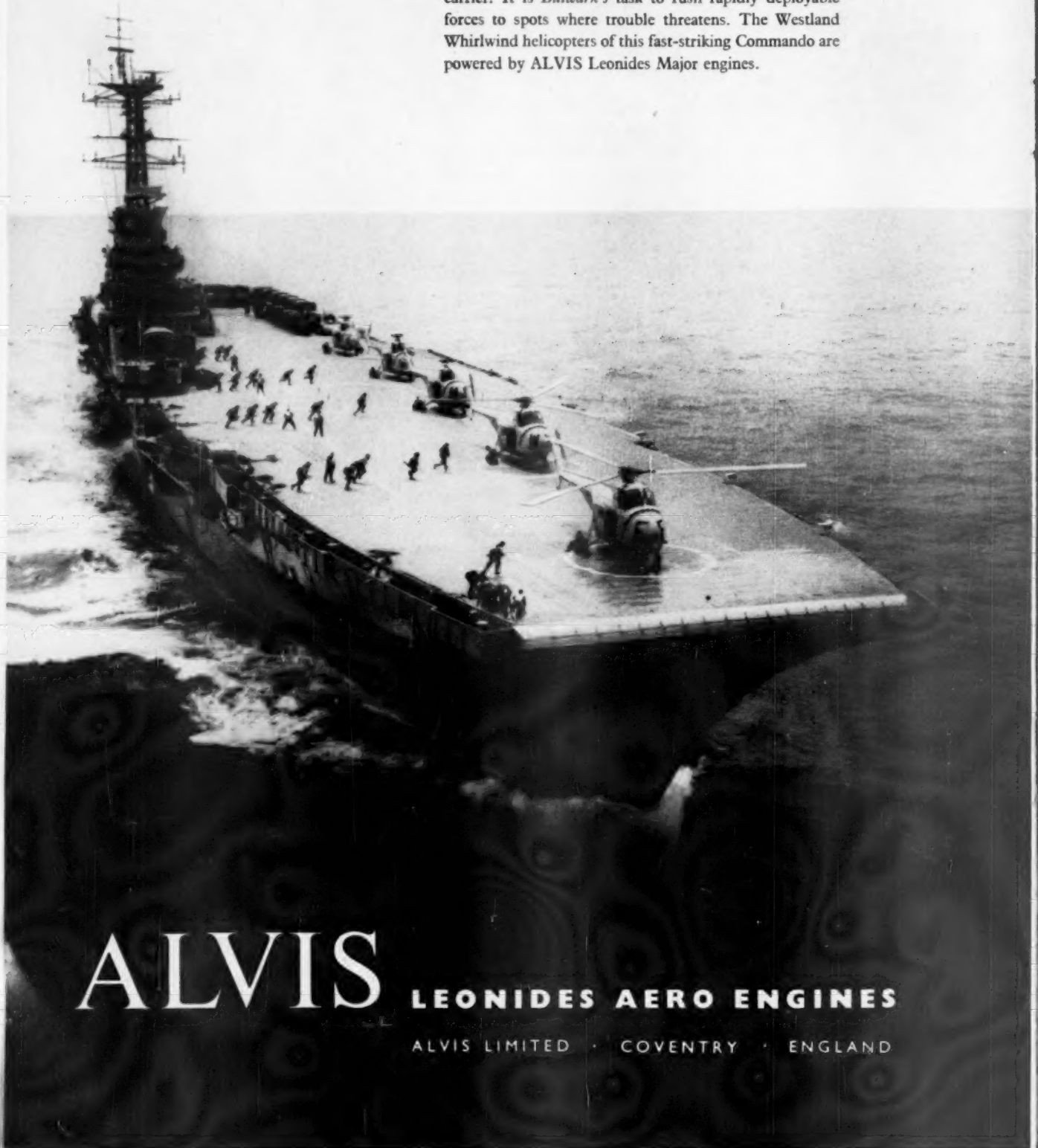
VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

Member Company of **BRITISH AIRCRAFT CORPORATION**

IGA AT681

Emergencies demand reliability

42 Commando, Royal Marines, is part of the complement of H.M.S. *Bulwark*—the Royal Navy's first Commando carrier. It is *Bulwark's* task to rush rapidly deployable forces to spots where trouble threatens. The Westland Whirlwind helicopters of this fast-striking Commando are powered by ALVIS Leonides Major engines.



ALVIS

LEONIDES AERO ENGINES

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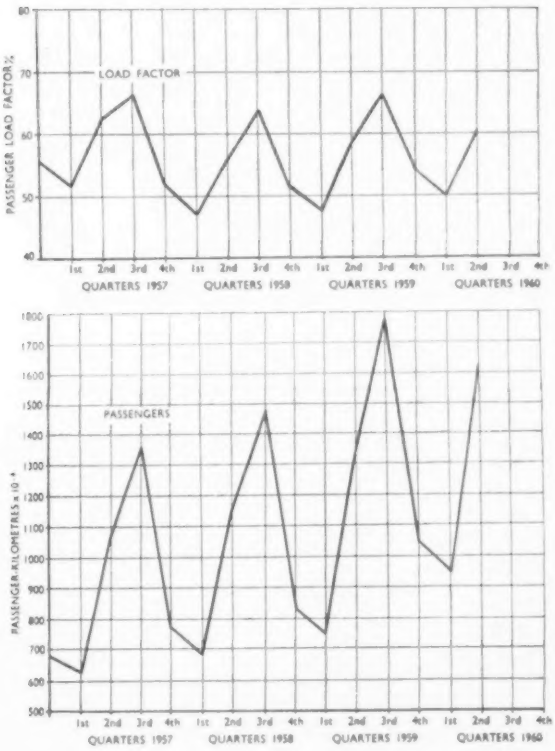
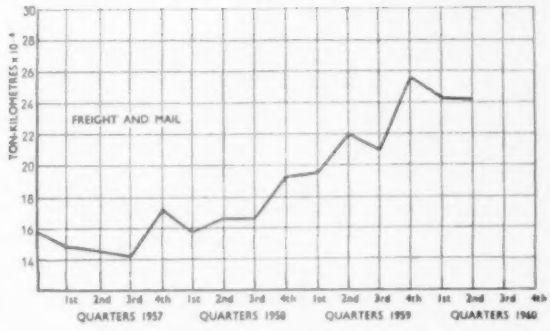
Air Transport . . . .

European Traffic Trends





AIR RESEARCH BUREAU statistics for the second quarter of 1960 show that the increased rate of growth of intra-European traffic in the first quarter of the year was sustained, at 22%. Capacity increased by 19%, so there was a 1.6 gain in load factor percentage points, to 60.6%.

Although freight traffic was still increasing, the rate of growth appeared to slow up somewhat, at 11.1%. However, on a moving annual basis, the increase of 22% in the twelve months ended June 30, 1960, was healthy, and rather better, in fact, than the 19% passenger/mile increase for the same period. In the second quarter, the capacity offered on all-freight services in Europe increased by more than 50%, and some 25% of all freight traffic is now carried on these specialized services.

	2nd Quarter		1960 as % of 1959	12 mths. ending		1960 as % of 1959
	1959	1960		June 1959	June 1960	
Seat/km. (mil.)	2,264	2,683	119	8,019	9,191	115
Pass/km. (mil.)	1,334	1,624	122	4,539	5,397	119
Pass. load factor %	58.9	60.5	—	56.6	58.7	—
Freight tonne/km. (mil.)	18.0	20.0	111	63.7	77.7	122
Mail tonne/km. (mil.) ..	4.0	4.2	107	15.9	17.6	110

Intra-European traffic includes all traffic carried on international routes originating and terminating within the European continent and countries bordering the Mediterranean. Airlines included in this survey are: Aer Lingus, Air France, Alitalia, BEA, Finnair, Lufthansa, Iberia, Icelandair, KLM, SAS, Sabena and Swissair.

Agreement with Hungary

A CIVIL aviation agreement was concluded on Oct. 25 between the U.K. and Hungary. The latest in a series of such agreements with East European nations, it provides for the operation of services between London and Budapest by B.E.A. and by the Hungarian airline Malev.

Malev (Magyar Legikozlekedesi Vallalat) was formed in 1946 as a joint Hungarian-Soviet undertaking to resume commercial operations. In 1954, the Soviet interest was withdrawn and the company became wholly Hungarian State-owned, the present name being then adopted. From Budapest, services are flown to the capitals of most of the countries of the East European bloc, to Moscow, and to Amsterdam, Brussels, Copenhagen, Vienna, Stockholm and Zurich. Mainstay of the Malev operations has been a fleet of Russian-built Li-2s and Russian- and Czech-built Il-14s, but these were supplemented last May by three turboprop Il-18s, with which the London service will most probably be worked.

B.E.A. expects to open its service to Budapest on Apr. 1, 1961, using Viscount 806s twice a week via Prague. The Malev service, starting at the same time, will be via Brussels.

Electra Reliability

WITH 135 Electras now in service with 13 U.S. and foreign airlines, Lockheed report that flight hours for the type had reached a total of 375,310 by the end of August. Average daily utilization is about 7 hours per aircraft. The introduction of jets by U.S. domestic operators this year has had a big effect on Electra operations, the average flight duration having been reduced from 3.8 hours in the first quarter of 1959 to about 1.5 hours by the middle of 1960. This trend towards short-haul multi-sector operations for the Electra was similarly indicated by the monthly total of landings per aircraft, which rose from 38.4 at the end of 1959 to 133 in mid-1960.

Despite this increased tempo of operations, delays attributable to mechanical faults showed a steady improvement. In the first seven months of 1960, the total of mechanical delays per 1,000 departures came down from 67 in January to 43 in August. The monthly average in 1959 was 91. A breakdown by Lockheed of the 10 principal causes of delays shows engines, propellers and associated equipment to be the worst offenders.

Three Electras are now reported to be undergoing extensive tests with the wing and engine-mount modifications shown to be necessary by the investigation into in-flight structural failures. Lockheed hope to have F.A.A. approval for the modified Electra by mid-December, when a start will be made on modifying all Electras in service as they are brought back to Burbank in rotation.

Second Pilot or Commercial Agent?

UNDER the above title in the Soviet weekly, *Grazhdanskaya Aviatsiya* some members of Aeroflot recently put forward their views on the rôle of the second pilot under present-day conditions. According to Aeroflot regulations the second pilot has seven main duties or requirements, as follows:—

(a) To understand the construction and details of operation of the airframe, engines and special equipment of the aircraft.
(b) To have sufficient flying and navigational ability to ensure the full safety and punctuality of the flight being made.
(c) To have knowledge of the basic rules for Aeroflot flights, and of the orders, instructions and directions of the Chief Directorate of the Civil Air Fleet which concern the flight drills and operation of the aircraft and its equipment.
(d) To be able to analyse and determine the meteorological situation before and during the flight.
(e) On aircraft equipped with radio, to be able to carry on two-way communication and to know how to employ all radio equipment.
(f) To give the necessary attention to the needs of passengers during the flight.
(g) To be personally responsible for the correct receipt, delivery, positioning and secure lashing-down of freight.

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The writers point out that the last item is one which absorbs all the second pilot's energies. Before flight he may have to receive 800 or 900 separate items of freight on an An-10, Il-18 or Tu-104, as opposed to the relatively small amounts on the older piston-engined aircraft. In flight he will have little time for anything except freight documentation—because all this has to be ready for the unloading on landing.

One writer advises the use of ready-packed freight and mail containers, so that the second pilot has to deal with only 12 to 15 items. A second writer, who is supported by seven other second pilots, describes how fines are exacted if freight is damaged or lost and how second pilots may have to watch over the freight for three to four hours before it is taken over by the ground freight organization at Vnukovo or Khabarovsk. This writer proposes that freight should be documented, loaded and sealed by the freight service on dispatch and the second pilot should merely be present to supervise. In this way he would be able to give his proper attention to the flying and operation of the aircraft and to assist his captain.

A History of British Airlines

IN "Britain's Imperial Air Routes, 1918 to 1939" (G. T. Foulis and Co., Ltd., 42s.), Dr. Robin Higham has produced a book which has long been awaited by everybody in this country with a really broadly based interest in air transport. Indeed, publication of the first serious attempt at a history of the international operations of the United Kingdom's airline industry, from its origins in 1919 up to the outbreak of War in 1939, is an event of some importance. It is, however, ironical—and, perhaps, a sign of the times—that such a book should have been written in the United States and only made possible by American interest and money. The author was born in London and educated at Bryanston, Hotchkiss and Harvard. He is now lecturer in history at the University of North Carolina, which, with the Shell Petroleum Company, financed this work. The author has obviously been able to spend a tremendous amount of time on exceptionally comprehensive research and on exhaustive study of his whole subject. The result is a history of real merit and of permanent value.

A factor in the production of this book—which, on balance, seems to have been particularly fortunate—is the interest which Mr. George Woods Humphery, the famous managing director of Imperial Airways, has been able to take in it and the help which he has given the author with source material, much of it apparently previously unpublished. Historians, with that so essential suspicion of any undue influence which might deflect the record from an optimum balancing of the facts, will feel that there is a danger that Mr. Woods Humphery may have unduly influenced Dr. Higham with his interpretations of some of the more controversial issues.

Deficient Public Relations

On the whole, however, the author seems to have effectively resisted any such pressures and to have maintained a properly independent viewpoint. There are, in fact, very few instances where the disinterested reader will have any doubts. Dr. Higham's independence of view is particularly emphasized when he reiterates strongly—and repeatedly gives evidence in support of—that often previously made criticism of Imperial Airways that the company's public relations were lamentably deficient. This weakness, combined with the equally misguided policy of secrecy about its plans and its past performances, was undoubtedly an important factor in the swing of public confidence in Imperial Airways which took place in the later 1930s, followed by the setting-up of the Cadman Committee, the replacement of Woods Humphery and final absorption of Imperial Airways into B.O.A.C.

In spite of the breadth and scope of the research on which this book is based and in spite of the considerable grasp of his subject which Dr. Higham has acquired as a result, and of which he has made such good use, there are occasionally curious gaps in his historical perspectives which one suspects may be due to insufficient knowledge of what has happened in air transport since the end of the period studied. Thus, many readers will be brought up short on the first page of Chapter I by the unqualified statement that Britain's stand in mid-1910 against Germany's proposal for freedom of the air was a "fatal mistake."

The wisdom of British international operating and traffic rights policy at different times during the past 50 years is certainly debatable. However, to conclude on the first page of a history of air transport—without even developing the arguments for and against—that Britain was completely wrong in 1910 to support a policy which has since won universal acceptance cannot surely be justified only on grounds that difficulties in obtaining operating rights in the 1920s and 1930s slowed down certain phases of the growth of Imperial Airways.

Would Britain's stand at Chicago in 1944 and the subsequent Bermuda Agreement have been possible if they had involved a complete volte-face on pre-War policy? Without Chicago or Bermuda, would British air transport be better off today? In absolute terms, healthier growth of the industry since the Second World War has been infinitely more worth while than any more rapid progress of the—by comparison—minute pioneer industry which might have been achieved earlier.

The treatment of technical and operational factors which impinge on policy most frequently reveals gaps in an historian's general knowledge of aviation. Dr. Higham deserves a lot of credit for avoiding most of the more common pitfalls. However, he still comes up with a few surprising contentions. One's reactions to the most interesting, about which, however, there may be some disagreement, are as follows:—

(1) It was not the small size of the Imperial Airways orders for aircraft which prevented British airliners from being built in numbers for export between the Wars. Small initial orders did not prevent Fokker, Junkers, Ford, Douglas and Lockheed from selling several types in quantity during this period. The inescapable truth is that British manufacturers, working to meet Imperial Airways requirements, did not produce sufficiently competitive equipment.

(2) The advantages of flight refuelling and of composite aircraft for scheduled airline operations are highly speculative. Indeed, a reasonable view today seems to be that British experiments in these fields for airline applications were a waste of time and money. The main objection to both is that there are such large directional and seasonal variations in the fuel loads uplifted on most long stages, that composite take-offs or air refuellings are required on only a proportion of flights. The resulting reduction in utilization of the parent or tanker aircraft increases the cost to an unacceptable extent.

(3) If the 1919 proposal to develop a British transport flying boat with a 1,200-mile range had gone ahead it is hardly likely that this would have prevented the Americans from establishing their lead in the development of long-range oceanic flying. The fact is, all types of aircraft in the inter-Wars period were deficient in several important respects—not just lack of range—for scheduled long-haul over-water operations, at any rate until the mid-1930s. The delays in starting services across the Atlantic were due far more to the lack of suitable aircraft than to political considerations.

(4) The lease of uneconomic and quite unsuitable military aircraft to Imperial Airways (such as the suggested Whitleys for mail carriage) would not have helped the company or British prestige. Experience after the War showed all too clearly the disastrous financial consequences of such a policy as well as its operational and technical problems.

One would have liked to have seen a more analytical approach by Dr. Higham to several aspects of his subject. Thus, the most interesting previously unpublished operating results of the pioneer Daimler Airway are not adequately discussed or explained (why, incidentally, do they appear in Chapter I?—they refer to the period after subsidies were introduced, whereas Chapter I is concerned with the pre-subsidy period). A thorough examination of Imperial Airways' policy of secrecy might also have been worthwhile. One just cannot accept the incredibly hackneyed, and usually completely unjustifiable, excuse that publication of more information would have helped competitors.

Another fascinating topic which is, perhaps, too lightly touched upon is the effect on planning of the serious underestimation by politicians and others—even during this inter-War period!—of growing nationalism in Commonwealth and other African and Asian countries. Another is the Air Ministry's policy of encouraging new operators to enter fresh fields when the Government was really committed all along to their "chosen instrument" and invariably granted it exclusive rights in the end.

However, the fact that readers will probably feel that they would have liked even more from this book than the very substantial sustenance which it actually provides is evidence of the value of Dr. Higham's work. He uncovers so many interesting lines of thought and of new inquiry—some as significant to the future as to the past—that his readers will wish to thank him most sincerely for a job so competently done.—PETER W. BROOKS.

Japan's Turboprop Transport

NEW and revised data for the NAMCO YS-11 turboprop transport have now become available, and are printed in our standard form below. Initiated in 1957 by the Transport Aircraft Development Association, the Dart-engined YS-11 is intended primarily to meet the requirements of Japan's national air transport operators, both domestic and international, and of the Japanese military forces. Development and construction of the YS-11 is now being undertaken by NAMCO—the Nihon Aeroplane Manufacturing Co., Ltd.—which was established in June, 1959, to succeed the Transport Aircraft Development Association as a joint venture by the Japanese Government and six aircraft manufacturing companies.

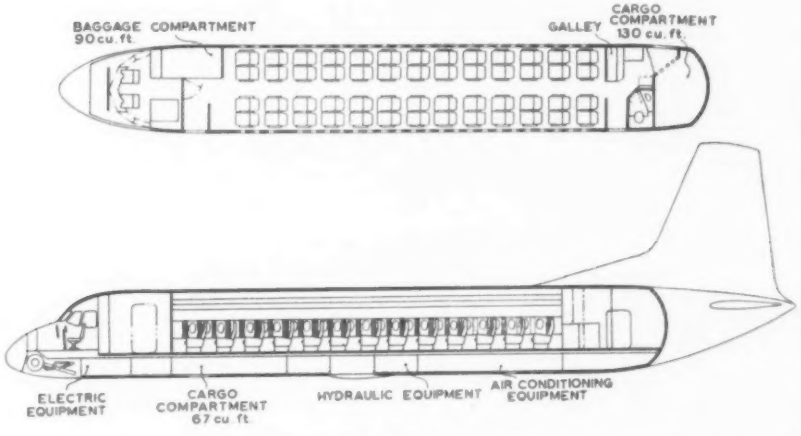
NAMCO has placed contracts with these six companies covering the construction of four prototypes, of which the first is scheduled to fly in December, 1961. Two of the prototypes will be used for structural and fatigue testing. Total value of these contracts is 2,157 million Yen, divided among the companies as follows: Mitsubishi, 54.1% (fuselages and final assembly); Kawasaki, 25.3% (wings and engine nacelles); Fuji, 10.3% (tailplane); Shin Meiwa, 4.8% (rear fuselages); Nihon Hikoki, 4.9% (ailerons and flaps); Showa Hikoki, 0.6% (honeycomb structure). Additional contracts worth 876 million Yen have been included in the fiscal 1961 budget of the Ministry of International Trade and Industry, to cover the purchase of jigs, materials and components for quantity production of the YS-11. The first production YS-11 is expected to be in service on domestic routes in Japan by the summer of 1963.

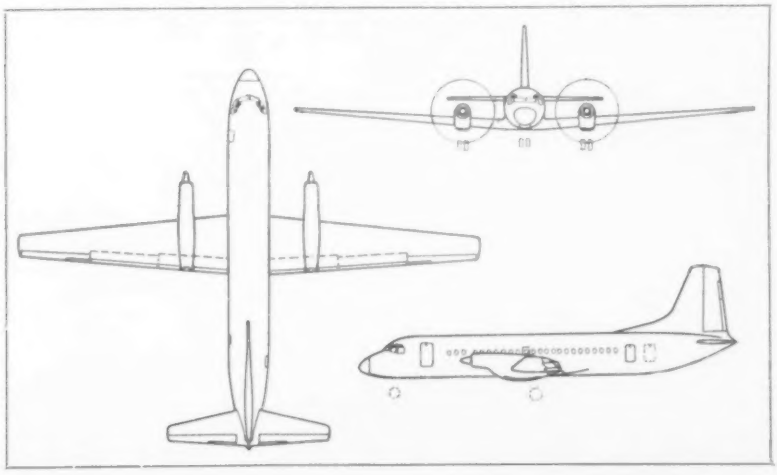
Keynotes of the YS-11 design have been good field performance and high profitability on short stages. Lowest seat-mile costs are developed over stages from 300 to 600 naut. miles. Calculated on the S.B.A.C. formula, they are 1.7 cents/passenger naut. mile at 3,000 hr./year utilization, and 2.2 cents at 1,500 hours. Using specially developed Dart RDa.10/1s with water-methanol injection, the YS-11 requires a field length (SR422B) of only 2,890 ft., or approximately 70% of the length required by a fully loaded DC-3, while carrying more than twice the payload.

Compared with the Dart RDa.7 on which it is based, the RDa.10/1 Mk. 542 for the YS-11 has a conical spinner; a larger intake for 16% increased air mass flow; increased capacity reduction gear; increased rotor guide vane throat area and increased diameter L.P. impeller; flame temperature increased by about 65° C. and air-cooled H.P. turbine blades. The take-off rating, using water-methanol injection, is a constant 3,060 e.h.p. at all temperatures from I.S.A. −35° to I.S.A. +30° C.

The structure is fail-safe, and designed for a life of at least 30,000 hours. The wing is a conventional two-spar structure in three sections, the centre section passing through the fuselage. Integral tanks are contained in the torsion box in the outer panels, and provision is made for bag tanks in the centre section. Fowler-type flaps are fitted.

The fuselage is pressurized to a normal differential of 4.16 p.s.i., and provides uninterrupted space for 52-60 seats, four-abreast. Hydraulics are 3,000 p.s.i. for the flaps, undercarriage, brakes, nosewheel steering, propeller brake, windshield wipers and ground cooling blower. Main electrical system is 28 volts DC from two engine-driven generators, with constant frequency AC through three inverters.





NAMCO YS-11

Dimensions
- Span: 105 ft. 0 in.
- Overall length: 86 ft. 3 in.
- Overall height: 30 ft. 0 in.
- Gross wing area: 1,020 sq. ft.
- Sweepback: Nil
- Internal cabin dimensions:
  - Length (ex. flight deck): 44 ft. 1 in.
  - Max. width: 106 in.
  - Max. height: 78 in.
  - Max. usable volume (ex. flight deck): 2,125 cu. ft.

Accommodation
- Normal first-class: 52 (4 abreast at 38-in.)
- Normal tourist: 54 (4 abreast at 34-in.)
- Max. coach: 60 (4 abreast at 34-in.)
- Volume of underfloor freight and baggage holds: 67 cu. ft.

Powerplants
- Two Rolls-Royce Dart 542 (RDa.10/1) turboprops.
- Take-off power each (I.S.A., s.l.): 3,060 e.h.p. at 15,000 r.p.m. with water-methanol.
- Rotol 14 ft. 6 in. four-bladed reversing propellers.

Weights and Loadings
- Basic operational (52-seats): 31,217 lb.
- Total fuel: 12,600 lb.
- Mfrs. max. payload: 12,125 lb.
- Max. take-off: 50,265 lb.
- Max. landing: 48,050 lb.
- Wing loading (max. t-o. wt.): 49.4 lb./sq. ft.
- Wing loading (max. landing wt.): 47.1 lb./sq. ft.
- Power loading (max. t-o. wt.): 8.2 lb./e.h.p.

Design Speeds (Above and below 13,000 ft.)
- Mmo/Vmo: 0.475/245k.
- Mne/Vne: 0.533/275k.
- Md/Vd: 0.601/310k.

Performance
- Cruising speed (I.S.A.): 253 knots (at 20,000 ft. and 44,092 lb.); consumption: 6.6 lb./naut. mi.; power (per engine): 1,430 e.h.p. at 14,000 r.p.m.
- Approach speed (at max. landing wt.): 94 knots with 40° flap.
- Take-off field length required (SR422B) (at max. t-o. wt. with water-meth.):
  - At I.S.A. at sea level: 2,890 ft.
  - At I.S.A. + 23°C at sea level: 3,200 ft.
  - At I.S.A. at 6,000 ft.: 4,080 ft.
- Landing field length required (SR422B) (I.S.A., s.l., max. landing wt.): 3,790 ft.
- Range (take-off to landing), I.S.A., still air, no reserves, max. fuel (1,560 Imp. gal.): 1,680 naut. mi. with 5,400 lb. payload at 247 knots (mean) at 20,000 ft. (mean).
- Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 700 naut. mi.

A New Airport in Oman

DUBAI civil airport was officially opened on Sept. 30 of this year. It represented the culmination of an invitation made by H.E. Shaik Rashid Bin Said Al Maktoum, Ruler of the Shaikdom of Dubai, in May last year, to International Aeradio (which concern has been operating the technical services at Sharjah Airport in the neighbouring Shaikdom for more than a decade) to undertake the construction, equipping and subsequent management of an airport.

Dubai is one of the seven Shaikdoms of the Trucial Oman which has a long history of friendly association with Great Britain. A general treaty of peace negotiated in 1820 with the Shaiks of the northern coast of the Oman was converted in 1853 into a treaty of "peace in perpetuity."

International Aeradio accepted the invitation and recommended that in the first phase the project should consist of a runway, taxi-track, aircraft apron and small terminal building capable of receiving aircraft up to and including the DC-3. Associated services together with the necessary technical equipment and accommodation to be: aerodrome control, airport fire service, a non-directional beacon, light and power, water and sanitation. The whole to be so engineered as to allow for ease of expansion at some future date.

An initial survey was carried out early in June in conjunction with Richard Costain, Ltd., of London, with a view to selecting a site and preparing estimates; the big question which had to be answered referred to the runway: would a natural compacted surface be suitable or was a made-up pavement necessary? Subsequently, general lay-out plans for the airport and buildings were prepared by International Aeradio and translated into architectural plans and drawings by Richard Costain, Ltd., who also carried out quantity surveying and construction of the manœuvring areas and buildings.

This arrangement permitted the closest co-ordination of all the technical aspects of airport construction and extended to the field of interior decoration. The architect and Druce and Company, who supplied the furnishings, were brought early together to ensure harmony of style and colour with that of the terminal building.

At first sight the area around Dubai looks like the airport "prospector's" dream come true. A seemingly endless flat and hard gravelly surface in all directions, with here and there a few low sand dunes and patches of permanent coarse vegetation, it represents not the true desert but steppe-desert. Some idea of this billiard-table-like quality is given by the longitudinal profile which shows a maximum difference of level of less than 6 inches in the 12,000 ft. strip in which the runway is located. Perhaps a record for the flattest and most level runway can be claimed.

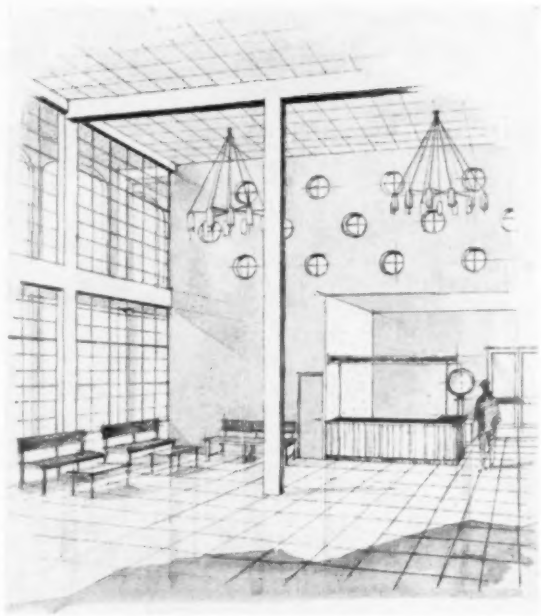
It has its problems though, paradoxically enough caused by water. The area is very low lying close to the sea-shore and from December to February the swell travelling south-east down the Arabian Gulf ahead of a cold front can be driven inland far beyond the high water mark by strong squally shamals (a local wind).

The airport elevation is only 1.42 feet above high water mark; a mean sea level value is now in the process of being established. Tests showed that the water table was no more than 3-4 feet below the surface which posed problems of siting buildings and type of foundation to be used; it accounts for the position of the terminal building relative to the runway.

After selection of the general area the question of runway direction had to be determined. Since only one runway was to be laid the selection of the optimum relative to wind direction was especially important. No meteorological records exist for the particular site. Guidance was first obtained from the Air Ministry Meteorological records at Sharjah nearby. It was evident that the familiar land sea breeze system prevailed, giving generally by day north-westerly winds with much lighter south-easterly winds by night. The proposed direction of 120-300° M was confirmed by local Arabs who also gave valuable information on sea water flood lines and areas, and on occasional rain water flooding which can be severe.

The annual average for Sharjah is 3.89 inches, but it is apt to fall "all at once" any time between November and January, a fall in 24 hours of 2.69 inches in November and 2.24 inches in January have been recorded. This phenomenon has an important bearing, particularly in relation to natural surface runways.

In determining runway length (6,000 ft.) no account had to be taken of either elevation or slope as both are virtually nil. An airport reference temperature (ART) of 41°C. was established, requiring an increase of the selected basic length of 21%. The actual length rounded out to 6,000 ft. is adequate for all types of aircraft likely to use the airport for some to come. There will be no all-up weight restrictions and consequently none on route stage-lengths required by operators. Turning circles are provided at each end of the runway with an additional turning circle approximately at two-thirds of the length of runway 12 to lessen the amount of back-tracking.



Inside Dubai's new airport.

The general layout allows for the provision of a parallel taxi-track and expansion of the apron when traffic volume and aircraft types warrant these additions. Obstruction clearances as for an instrument runway can be met now and in the future.

Dubai as an international airport is probably unique in not having any customs, immigration or other form of governmental controls. This simplified considerably the planning of passenger and baggage flow and the segregation of internal, external and transit passengers (very little freight traffic is at present foreseen) besides removing the irksome delays which seem a *sine qua non* of such formalities.

Seating and tables are provided in the concourse and light refreshments are obtainable. A roof verandah runs the length of the building on the aerodrome-side and is open to the public as an observation and waving platform. A taxi service to town, some two miles away, is available.

Great importance has been attached in the overall design to ease of expansion as required in the future without costly structural alterations. The layout caters for the expansion of the concourse and addition of a Customs area (if ever required) at the east end of the building by a comparatively simple rearrangement of the booking-office and baggage exit.

The building is a reinforced concrete structure stressed to take two full storeys, with a ground slab designed to act as complete column and wall foundations built up above the natural level of the site. Cladding and internal walls, which are non-load bearing, are of locally made rendered cement blocks. The choice of material was in conformity with the natural local desire that the resources of the Shaikdom should be drawn upon as far as possible.

With few exceptions, all building materials and fittings were obtained in Dubai as was the building labour force, though plant for the runway had to be imported as none was available locally.

The air traffic control tower, prefabricated by the Critall Manufacturing Company to a basic International Aeradio design specification, is located on the terminal building in line with the central taxi-track. An excellent all-round view as well as complete sight of all the manœuvring areas is obtained. Features of the tower are dwarf walls, outward sloping windows double glazed with anti-sun glass, double roof; and, to add to the comfort and efficiency of the controllers, air conditioning has been installed.

Aerodrome control only is exercised from an International Aeradio ATC console by means of a VHF R/T air/ground channel. Approach control is provided by Sharjah, and the two towers are in direct two-way communication by a VHF point-to-point channel. A MF non-directional locator beacon, monitored in the tower, is provided.—G. R. STROUD, A.F.R.Ae.S., M.I.N.

Mach-3 Bomber for the Mid-1960s

Details of the North American B-70 Valkyrie

AS both a Mach-3 strategic bomber for the U.S.A.F. and a potential supersonic airliner, the North American B-70 Valkyrie is probably the most important aircraft now under development in the United States. An immense amount of information about this project has recently been given in the report of a Senate sub-committee;* it forms the basis of this article, which is the first detailed description of the B-70 to appear here.

Development of the B-70 as an operational Mach-3 bomber has been resumed following a cut-back in December, 1959. The U.S.A.F. is very keen that the B-70 should be produced to replace the B-52, so that it can retain in future a mixed deterrent force of manned bombers and ICBMs. It also argues that the B-70 will compel Russia to improve its defences at a cost of $40,000 million, which is four times as much as it will cost to produce a B-70 fleet and operate it for years.

The B-70 is designed to cruise at Mach 3, or 2,000 m.p.h., at altitudes of 70,000 ft. and above. Its range is to be more than 6,500 nautical miles without refuelling. With a single KC-135 refuelling it could attack any target in Russia from U.S. bases.

As an example of its ability to reach any trouble area in a hurry, assume that a Chinese invasion set out at 10 kts. to cover the 100 miles between the mainland and Formosa. If U.S. military headquarters heard about this one hour after the fleet had sailed, B-70s could be scrambled from San Francisco and reach the fleet before it was half-way to Formosa.

The aircraft has been designed for a reaction time similar to the scramble of interceptors. This is made possible by the "shirt-sleeve environment" which eliminates bulky flying gear for the crew, and the aircraft's attached alert pod which provides power to keep sub-systems warm and to start all engines simultaneously.

B-70 Background

For more than two years before an official U.S.A.F. requirement was issued in 1954, the U.S.A.F., N.A.C.A. and certain aircraft companies had been studying a bomber to succeed the B-52. On Oct. 14, 1954, the U.S.A.F. issued GOR No. 38, which was a "General Operational Requirement for an Intercontinental Bombardment Weapon System Piloted Bomber." A chemical-fuelled bomber, it was to be in service with Strategic Air Command between 1965 and 1975.

A.R.D.C. issued a study requirement, SR. No. 22, which identified the project as "Weapon System 110A" and set 1963 as the target date for the first wing of 50 operational aircraft. Performance objectives were Mach 0.9 for cruise and "maximum possible" speed during a supersonic 1,000-nautical-mile penetration beyond the Russian early-warning radar line. It stipulated that high speed was of less importance than the penetration altitude and radius.

On Mar. 22, 1955, a second general operational requirement, GOR No. 82, was issued which superseded GOR No. 38, and A.R.D.C. issued a revised study requirement to supersede the original SR No. 22. The speed requirement was modified slightly: "Aircraft cruise speed should not be less than Mach 0.9 unless a significant increase in maximum radius of action or in combat zone may be obtained. Maximum possible supersonic speed in a combat zone is desired."

On Apr. 6, 1955, the Weapon System 110A Project Office was formed at Wright Air Force Base. It proposed that the weapon system should be developed and delivered in quantity by 1963.

On June 21, 1955, the U.S.A.F. Deputy Chief of Staff for Development ordered that WS 110A development should be started with a multiple competitive programme. Six contractors were asked to submit proposals but only Boeing and North American chose to do so. Both were awarded phase 1 contracts in November, 1955; these called for mock-up completion by November, 1957, first flight in March, 1960, and for the first S.A.C. wing to enter service in December, 1963.

Preliminary design proposals were submitted by both companies in April, 1956. The U.S.A.F. was dissatisfied with the aircraft as proposed, and in October ordered that development should be ended and that Boeing and North American should continue studies only on a reduced R. and D. basis. In effect, the programme was cancelled.

This was because the designs showed that to meet the range and payload requirements the aircraft might weigh 750,000 lb. or more and that it would need giant outer wing panels carrying vast fuel tanks (weighing about 190,000 lb. each) which would carry fuel for the outward trip and then be jettisoned, giving a supersonic dash speed without wing tips of Mach 2.3. Gen. Le May is reported as having said: "This isn't an airplane—this is a three-ship formation." In addition to the high gross weight and possible unreliability of the large jettisonable tanks, the U.S.A.F. was dissatisfied with the pilots' visibility, which was affected by the large delta foreplane. The contractors were ordered to return to the drawing board. It was suggested that the use of high-energy fuel and boundary layer control should be studied as means of improving range.

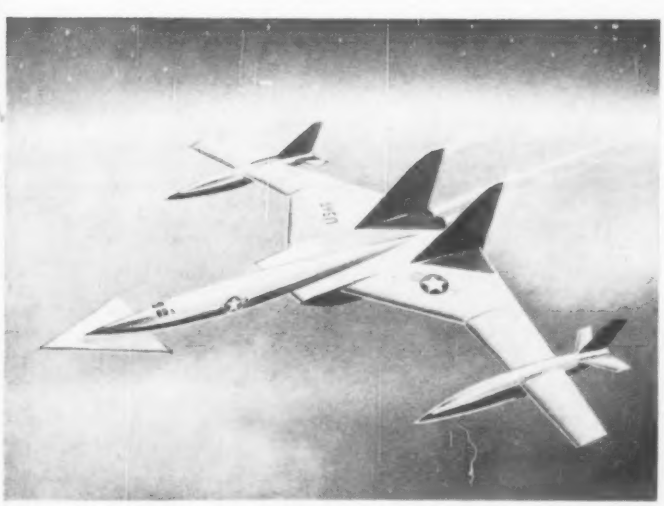
In July, 1957, both companies presented new proposals; independently they had both concluded that, with afterburning of high-energy fuel, the WS-110A aircraft could cruise at supersonic speed instead of being a split-mission type with a subsonic cruise and supersonic dash performance. This was made possible because of advances in aerodynamics, and improved intake and structural efficiency. The main aerodynamic advance was the use of favourable shock-wave interaction, or "compression lift" to improve the cruise L/D. The principle has been compared with the effect experienced by a speedboat when it rises on to its step.

A very thorough assessment was made of the Boeing and North American facilities and proposals by the U.S.A.F. There was unanimous agreement by teams from A.R.D.C., S.A.C. and Air Materiel Command that the North American project was the best and in December, 1957, it was announced that the company had been selected as the WS-110A contractor. A contract was signed in January and General Electric was appointed associate contractor for the J93 engine. The programme covered the production of 62 aircraft, 12 for operational evaluation and 50 for the first S.A.C. wing. First flight was to be in January, 1962, with equipment of the first wing to be completed by August, 1965. Total cost of research, development and production would have been $3,300 million (approximately £1,175 million).

In April, 1958, the design of the B-70 was reviewed by the U.S.A.F.; the most significant change was an increase in all-up weight "to fully exploit the inherent air vehicle load and volume capabilities and to minimize the probability of future changes on retro-fit."

In March and April, 1959, the development engineering and mock-up inspections were held. At the first, 761 requests for alterations were made, of which 381 were considered to come

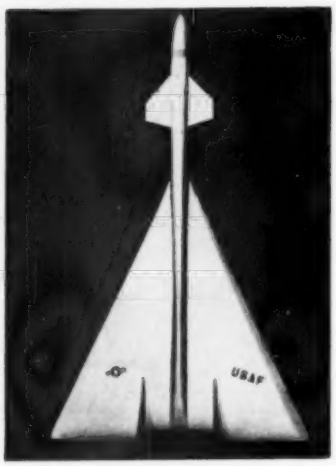
*"The B-70 Program": Report of the Preparedness Investigating Subcommittee of the Senate Committee on Armed Services.



B-70 ANCESTOR.—First proposals in the B-70 programme were for a subsonic-cruise/supersonic-dash aircraft weighing 750,000 lb. Outer wing panels and fuel tanks were to be jettisoned before supersonic flight over enemy territory.

under the contract, and there were 35 alterations to be made as the result of the mock-up inspection.

Two 1959 decisions which affected the B-70 were the cancellations of the high-energy fuel and F-108 interceptor programmes. The J93-5, which used high-energy fuel, was cancelled, but the J93-3, under development for the F-108, had a similar thrust and could be used in the B-70. Because of



PLANFORM.—Leading-edge droop can be seen in this plan view of a B-70 model.

design improvements the calculated range of the B-70 had reached a point where high-energy fuel was no longer needed to reach the minimum design range. Its elimination greatly simplified the fuel system and reduced the cost of B-70 operation. Burning high-energy fuel in the afterburner would have increased range by about 10%; flight refuelling by a KC-135 gives about a 20% increase.

Cancellation of the F-108 programme in September, 1959, affected the B-70, because both were being developed by North American and some features of the programmes were common to both.

On Dec. 3, 1959, the blow fell. After a review by the President, Secretary of Defense and Director of the Budget Bureau, the U.S.A.F. was ordered to cancel the programme. The President announced that it was not cut back for budgetary reasons. Cancellation was not complete; steps were taken to produce only a single prototype. At this time some 8,250 hours of wind-tunnel testing had been completed and over 100 hours running on the J93 turbojet. North American had devoted about 6 million design man-hours to the project. General Electric had spent 695,000 man-hours on the propulsion system and about 195,000 man-hours had been devoted to the bombing and navigation system.

The new programme called for only a prototype Mach-3 aircraft, stripped of all military sub-systems. Many sub-contracts were cancelled, the most important being with I.B.M. (bombing-navigation system), Motorola (communications), Westinghouse (defence sub-system), Boeing (wing), Lockheed (part of the fuselage) and Chance Vought (control surfaces). Under the new programme the first-flight date was to be delayed 11 months, from January to December, 1962. Money allocated for the programme in the 1960 fiscal year was reduced from $345.6 million to $150 million, and in the 1961 fiscal year from $456 million to $75 million.

In January this year, however, the U.S.A.F. ordered that development of the bombing-navigation system should be resumed at a reduced rate. Later this year, as a result of the deterioration in the international situation Congress voted an additional $290 million for B-70 development in the 1961 budget; this was over and above the $75 million which the U.S. Government had requested for the reduced programme.

As a result, the U.S.A.F. stated in September that steps were being taken to reinstate development of the B-70 as a military aircraft. On this basis, and with adequate funding in future years, it is expected that the first S.A.C. wing of 50 B-70s could be equipped by the autumn of 1966. This is the U.S.A.F. plan, but the government has apparently not yet definitely given the go-ahead for B-70 production, although prototypes will be built with military sub-systems. Two prototypes are now contractually committed.

B-70 Description

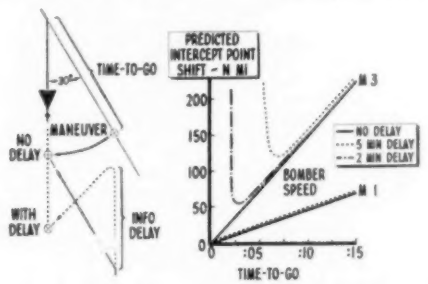
The B-70 is a Mach-3 strategic bomber similar in size to the Boeing B-52H and about 10% heavier. Of canard layout, it has a large delta wing and a long fuselage. It is powered by six General Electric J93-3 turbojets burning JP-6, a hydrocarbon fuel similar to the widely used JP-4 jet fuel. Total thrust is almost three times that of the B-58 Hustler bomber. Engines are mounted under the wing close to the trailing edge. They are supplied by a long intake duct; this produces a shock-wave system which interacts favourably with the delta wing to give a good cruise lift/drag ratio.

The four-man crew (pilot and aircraft commander, co-pilot, bombardier/navigation officer and defensive system officer) sit in the front section of the fuselage with most of the electronic equipment; they can reach electronic components in flight. Fuel is carried in sections of the fuselage and in the wing.

The large bomb-bay, which is almost 30 ft. long, can carry any of the nuclear weapons now stockpiled or planned. It is designed to carry combinations ranging from the smallest weapons up to those which can deliver over-pressures capable of destroying all but the hardest and extremely deep targets. Its bomb-bay can also be adapted to carry non-nuclear bombs.

The delta wing of the B-70 has elevons for roll and pitch control; the foreplane can be rotated for longitudinal trimming. This foreplane also has trailing-edge flaps, making it possible to droop the elevons to act as flaps. The large wing area and this "dual flap" system make possible the relatively slow take-offs and landings which will permit the B-70 to operate from existing heavy-bomber bases. Yaw control is provided by two fins and rudders.

A high ratio of fuel weight to gross weight is achieved with a structure which remains efficient at the high temperature of



EVASION.—A 30° turn by a Mach-3 bomber towards an attacking weapon shifts the predicted intercept point considerably. Variation of this shift is shown for turns made up to 15 minutes before the predicted interception and for delays in giving new information to the weapon.

Mach-3 flight. Brazed stainless-steel honeycomb sandwich is used for most external surfaces; it gives high strength for weight, adequate fuel insulation, aerodynamic smoothness and panel stiffness. Welding is used extensively for the fabrication of steel parts, and the assembly of panels and major components. Titanium alloys are used where possible.

Within the B-70 the crew and equipment quarters are kept at 75° to 80° F. and at a pressure altitude of 8,000 ft. The crew can work in shirt sleeves, and do not need protective clothing or oxygen masks. In emergency an encapsulated ejection seat will close round each crewman and provide the pressure and oxygen needed for survival. With this capsule safe ejections should be possible at speeds between 2,000 m.p.h. and 100 m.p.h. and altitudes from above 70,000 ft. down to sea-level.

Military Systems

Systems of the B-70 are divided between aircraft sub-systems —those required to get the B-70 into the air, operate there, and back again—and military sub-systems. These make a bomber out of an aircraft by giving it the capacity to navigate, release weapons, defend itself and communicate.

The bombing and navigation sub-system, being developed by I.B.M. is operated by a bombardier-navigator officer sitting directly behind the co-pilot.

Existing techniques for inertial navigation using gyro-stabilized platforms have been applied and improved upon. Automatic star-tracking has been incorporated. A computer accepts programmed data before a mission, accepts additional inputs from sensors and the operator and continuously computes present position and "time and distance to go" to the target.

A search radar has been planned which in certain modes of operation will give such improvement in definition and contrast as to make a radar return look almost like a photograph. A new technique, discovered and flight-tested within the past few years, makes this possible. This greatly improves the chances of identifying obscure targets and vastly increases the

TAKE-OFF.—Beneficial shockwave interaction between the B-70's underslung engine nacelle and wing has been used in the design, of which this is an artist's impression, to provide a good cruise lift/drag ratio.

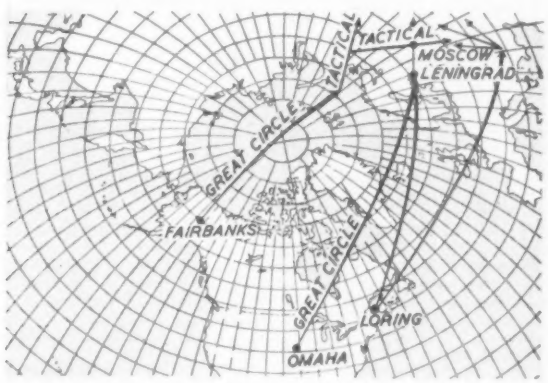
number of checkpoints that can be recognized and employed as bombing aids. New Doppler radar techniques are also utilized.

The system is being designed to incorporate in future the ability to launch an ALBM accurately. Breadboard, experimental models of the system have had over 400 hours of flight testing.

Defensive Sub-system

Under development by Westinghouse, this system is designed to complement the performance characteristics of the aircraft (high speed and high altitude) and its capacity for random flight path variation and optimum tactical employment.

The B-70's altitude and high speed alone should provide a considerable degree of protection during the first part of its life. Defensive measures planned for the weapon system will greatly extend this protection; they will be more versatile than those currently in use.



PENETRATION ROUTES.—B-70s could fly great-circle routes to the limits of Russian radar cover and then turn on to tactical routes planned to avoid and confuse the defences. Possible routes are shown.

The defensive-system operator, who sits directly behind the pilot, can assess the active and passive measures being taken by an enemy to locate and attack the B-70. Radar and infra-red sensors provide inputs to visual displays. The operator can use the radar transmitters at his disposal in a number of modes and in all useful frequencies to jam or confuse enemy radars. He will be able to counter IR-seeker missiles and employ decoys of various types if the threat makes this necessary.

S.A.C. and Air Defence Command exercises have shown that the defensive measures by attacking bombers can be effective even when used by a single aircraft. Their effectiveness is increased tremendously when the number of attacking bombers is increased and teamwork is brought into play. When aircraft performance is exploited tactically—by saturation, attacks at high and low altitudes, and criss-crossing penetrations—the job of a defender is increased greatly. If ICBMs have preceded the bombers, the chances for bomber survival are still greater.

All the bomber's defensive measures are designed mainly to introduce time delays into the opposing defensive system. In a 2-minute time delay a Mach-3 bomber will move 60 miles, which could put it out of reach of some defences, and may bring it into the sector of other defences not ready to counter it.

The communication, navigation, identification, and landing-aid equipment is collectively referred to as the mission and traffic control (M. and T.C.) system. Motorola was developing this system, with the military designation of AN/A5Q-43, for the B-70 until its contract was cancelled. The contract will probably be renewed.

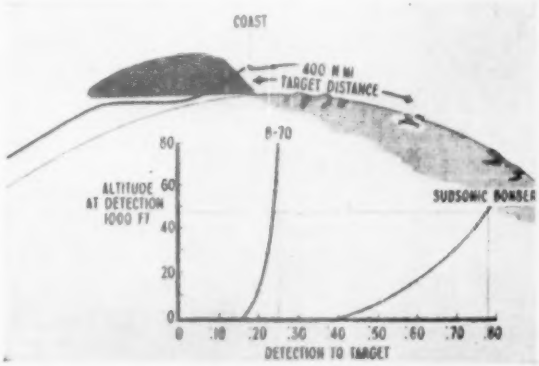
Short-range voice radio was planned for normal communication within line of sight. This equipment (SRVR) is used to communicate with the tower, with air traffic control, and between aircraft.

For operation beyond line of sight, long-range radio equipment (LRR) capable of either voice or teletype use was planned for command control, in flight redirection including S.A.C.'s "positive control" recall system, for battle-damage assessment and for reconnaissance reports. Worldwide communication is now possible and was planned by the subcontractor.

Aids to navigation within the continental United States included a highly improved version of TACAN (tactical air navigation). As part of the B-70's M. and T.C. system, other equipment was to include IFF, an automatic crash locator beacon, rendezvous equipment to give flight information and tanker positioning for inflight refuelling. ILS with a flare-out altimeter was provided as a part of the integrated system, to provide absolute height information for use by the pilot in his final approach.

Penetrating Defences

The B-70 was designed for effective penetration against the defences expected during its operational life. This is to be



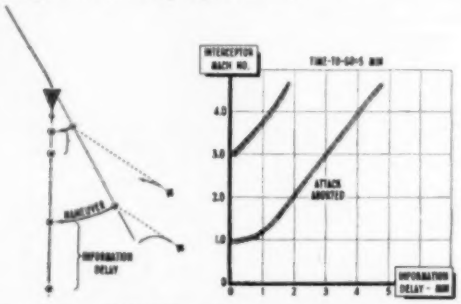
ALTITUDE FLEXIBILITY.—The time in minutes between radar detection of a B-70 and its arrival over a target is compared with that for a subsonic bomber. After detection the B-70 climbs to cruise altitude and accelerates to Mach-3.

achieved not only through performance, but also through the flexibility with which it can be employed. Flexibility in route selection, tactics, altitude, speed, armament, and defence measures all improve the chances of survival.

A speed of Mach 3—slightly faster than the muzzle velocity of an Army rifle—reduces the reaction time available to the defence decision and commitment system, and reduces the number of weapons which can reach the bomber.

If the defence system reacted instantly with no delays in decision and command, the number of interceptor weapons reaching a bomber strike would vary inversely with the bomber speed; thus, a Mach-3 bomber would be reached by only 11% of the weapons reaching a Mach-1 bomber. In an actual penetration, however, this ratio is more favourable to the higher-speed bomber, because of time delays in the defence system.

Defence time delays result primarily from the relay of information between parts of the defence system and from the difficulty the ground stations experience in discriminating between radar targets and in obtaining adequate range information. Time delays are increased markedly by confusion resulting from the use of electronic counter-measures (ECM), damage to the defender's communication and control system, and changes in course by the bomber.



COUNTER MEASURES.—ECM equipment in a bomber helps to increase information delays in a defence system. The effect of these is shown if a bomber makes a 30° turn away from an attacking weapon (upper curve) or towards it (lower curve), five minutes before a predicted interception. In each case the combination of interceptor speeds and delays below the curves results in an abortive attack, and the interceptor will not reach the bomber.

Manœuvrability greatly helps a supersonic bomber to avoid interception. An attacking weapon must be vectored towards a predicted intercept point a considerable distance ahead of the bomber. Any change in bomber heading greatly affects the position of this interception point and the ability of weapons to reach it. For example, if a Mach-3 bomber makes a 30° turn towards an attacking weapon 15 minutes before the predicted impact, the intercept point will shift by 225 naut. miles. There is a further complication if there is an information delay.

As the diagram on this page shows, with a five-minute time-to-go to intercept, a 30° turn toward the attacker will evade a Mach-1 weapon even with no information delay and it will evade a Mach-2 weapon with a two-minute delay. A 30° turn away from a Mach-3 weapon will prevent it attacking under all conditions.

Operational studies have shown the effect of random manœuvres by a Mach-3 bomber under attack by a Mach-3 defensive weapon. In this case the effectiveness of manned interceptors can be reduced by 50% and that of surface-to-air missiles by 65%. If the bomber's manœuvres are planned with knowledge of defence site positions and weapon limitations, the effectiveness of the defence can be reduced even more; the bomber-survival rate for pre-planned manœuvres is 50% higher than for random manœuvres.

The B-70 is designed to provide a threat at all heights between sea level and 80,000 ft.; this altitude flexibility greatly increases the defence difficulty. It also allows operation above 70,000 ft., which is considered to be the current effective ceiling of Russian interceptors and missiles.

The B-70 would also rely on penetration route flexibility. Its design range of more than 7,500 naut. miles with a single KC-135 refuelling was chosen to give 100% coverage of the U.S.S.R., using great circle routes to the perimeter of Soviet radar defences and then planned tactical routes for the attack.

Supersonic Transport

Transport versions of the B-70 have been studied and three different versions proposed. The first, which could be available by late 1963, represents the minimum conversion of the bomber.

By 1966 a more extensively modified version could be produced for operation by the Military Air Transport Service as a cargo and passenger transport. This aircraft would retain J93 engines, but would have a fuselage of greater diameter to improve volume, loading and operation. It would carry 107 military passengers. In the cargo rôle it would carry 75,000 lb. for 2,470 naut. miles or 36,000 lb. for 2,930 naut. miles. A commercial version could carry 80 first-class or 108 tourist-class passengers.

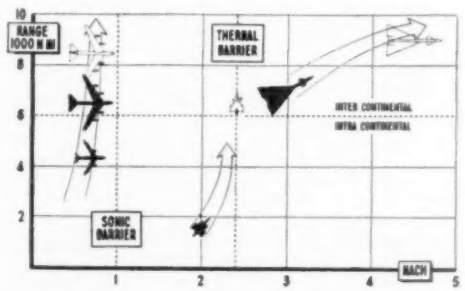
By mid-1967 it is considered that a competitive commercial transport could be produced. It would be powered by a turbo-fan version of the J93, and its fuselage and systems would be modified to permit F.A.A. certification. Equipped with thrust reversers this supersonic airliner could operate from airports with a runway length equivalent to 10,500 ft. at sea level. It would cruise at Mach 3 (1,980 m.p.h.) at 70,000 ft. A typical block time for a flight between New York and Paris would be 2.42 hours.

Operating costs have been calculated for transport B-70 operations during 1968. Assuming 3,000 hours utilization a year, and extrapolated currency inflation factors the cost will be 2.5 cents per seat mile for a typical transcontinental flight and 2.75 cents per seat mile for a transoceanic flight, assuming 90 passengers are carried.

Nuclear Version

Under a U.S.A.F. contract North American is making a special design study of a possible nuclear-powered version of the B-70. This would give a bomber with almost unlimited range and endurance. It could maintain a long-duration standing patrol carrying ALBMs, could approach an enemy target from any direction without aerial refuelling and could launch an attack at any speed from Mach 0.9 at sea level to Mach 3 at altitude.

Possible roles, in addition to strategic bombing, would be anti-submarine patrol and attack; early detection of hostile aircraft; interception of attacking forces at great distances from the U.S.; ballistic-missile early warning and use as a launching platform for anti-ICBM missiles; airborne mobile command post; and use for rapid deployment overseas for action in limited wars.



PERFORMANCE.—Range and speed of the B-70 are compared with those of the B-47, B-52 (Mach 0.77 cruise) and B-58 (Mach 0.92 subsonic cruise, Mach-2 supersonic dash). The arrows show likely development of current types, including the B-52H which has an 8,500 naut. mile range without flight refuelling.

Several features of the B-70 make it suitable for operation with nuclear power. Its large size is an advantage, because of the weight of reactor and crew shielding. The long distance between the crew and the powerplant would help minimize radiation. It also appears that much of the aircraft's basic structure could be retained without significant changes.

Recoverable Booster

Another possible use of the B-70 is as a recoverable first-stage booster for launching anti-satellite missiles or putting space vehicles into orbit.

It is estimated that the vehicle could be used to launch payloads of up to 15,000 lb. into orbit, at an average saving of $2 million per launch compared with the current use of non-recoverable boosters.—J.R.C.

B-70 Technical Data

DIMENSIONS.—Length, 170 ft.; wing span, 115 ft.

WEIGHT.—Take-off weight, approx. 550,000 lb.

POWERPLANT.—Six J93-3 turbojets; total thrust with reheat approx. 200,000 lb.

PERFORMANCE.—Cruising speed, Mach 3; cruise altitude, 70,000 to 80,000 ft.; range, more than 6,500 naut. miles (without flight refuelling).

DC-8 Confessional

"Confess yourself to heaven;
Repent what's past; avoid what is to come"—(Hamlet)

THERE are various, and vicarious, ways of confessing. Some devout souls prefer to cleanse their heresies in the quasi-privacy of the confessional box; others, such as the disciples of Dr. Buchman, practise their self-revelations more in the open in a spirit of joyful togetherness ("I can out-confess you, Jack," sort of thing!); engineers, being sceptically ingrained by training with the "show me" attitude, are more inclined to kill the sacred cows—especially the pets of their superiors—when they assemble in their particular form of togetherness known as a bull session. We confess we enjoy this kind of bull fighting—with a red handkerchief tucked up our sleeve. The latest occasion was a meeting of the S.A.E. in Los Angeles when some of our Douglas friends lived up to the well-worn adage that "confession is good for the soul." This confessional patter was directed towards recent improvements in the performance and handling of the DC-8.

The long-exercised rivalry between Boeing and Douglas in the transport sphere of design, culminating in the operational shakedown of the long-range jet liner, has yielded some oddly self-revealing mods, stemming mainly from the peduncular wing-engine pods that are such a predominant design feature of the 707 and DC-8. Arising directly from this blind alley concept—a hard fact that can hardly be disputed or side-stepped any longer—both design teams have come up against some formidable problems which have been met and overcome with some pretty ruthless (and expensive) fixes—a national characteristic which goes right back to the pioneering days of America and is still a noticeable by-product of the American dynamics of today. Perfection may be a transcendental trait in the next world, but survival and expansion are primeval to the New World. The customer must not be kept waiting and the darned thing must be made to work somehow, for tomorrow there is always a competitor working up some new gimmick—and, moreover, the brochure to beguile it!

Speaking as a non-American observer, while we have more than a sneaking admiration for American dynamics, we occasionally wince at some of the aerodynamics that have given rise to what are aptly called "aerodynamic crutch" solutions—not to mention the unsophisticated sales ballyhoo that is supposed to balance the crutch. A particularly crude example of this coercive therapy is the "barn door" type of leading-edge flap now grafted on to the 707 wing. Fundamentally, from the standpoint of airflow mechanics, the partial span leading-edge slots now being applied to the DC-8 and the latest Convair 880-M are a much cleaner and more effective modification programme. The wing slots of the DC-8 (they are valved-door slots, not movable slats) are located just inboard of each wing-engine-pylon intersection and cover about 40% of the wing span; they are effective in smoothing out the interference effect at the oblique intersection, maintaining the maximum lift of the basic wing and hence the original clean-stall characteristics.

Nevertheless, since the localized wing slot is but a half-way house to the eventual incorporation of full-span leading-edge slots (or slats) it must be accepted as a tacit confession of repentance. If only the designer could start all over again from pencil scratch it is a tolerable certainty that he would go for the full-house. Indeed, this emergent pattern can now be seen in the brochures—albeit some 10 years late. Apropos which, it may be recalled that Douglas' bid for the short-medium range jet in Jne., 1959, the DC-9 scaled-down copy of the DC-8, was drawn up *ab initio* with full-span leading-edge slats. Some 30 years ago, when this writer was a bright young project designer at Douglas, he hopefully schemed up a fully slotted wing, but was shot down (by a roving college professor-consultant) on the grounds that you couldn't de-ice a slotted leading-edge. It is, therefore, stimulating to report progress. It is also only fair to observe that the El Segundo Division of Douglas, under the brilliant engineering leadership of Ed Heinemann, has long been one of the foremost exemplars of the slotted wing art in its application to naval carrier aircraft.

Because the wing is the basic sustentation mechanism of the aeroplane in flight, one might have taken it for granted that "cleanliness before podliness" would be as holy a design rite as the Hindus' sacred cow. One does not have to be a bright young aerodynamicist to sense that when a wing has built-in barnacles it must take quite a buffeting; and when the barnacles are suspended on parasitic peduncles oblique to the wing, the buffeting builds up into a beating—especially at high wing angles and lift coefficients. The wing with underslung engine pods is, in fact, taking a double beating, since both the lift and drag are deleteriously affected. Strangely, though, in the U.S.A., it has been the professional aerodynamicist, blindly following the national fashion circuit that began with the advent of the Boeing B-47 bomber, who has been surprised to find that, in addition to the engine pod drag (about 11% on the DC-8), the parasite stalks in between are a source of unmitigated nuisance. As a consequence, many Douglas man-hours have been expended on learning how to coexist with this parasite.

Beginning with aircraft No. 148, the most recent design change—a ruthless one, we imagine, from the tooling aspect—is a revision to the nose profile of the wing which extends the chord (at the leading-edge) 4% along the entire span and increases the wing area from 2,773 to 2,868 sq. ft. The basic (original) DC-8 wing was designed for operation at a $C_L = 0.3$, but at the higher lift coefficient associated with long-range cruise conditions and higher take-off weights, flight tests showed a higher than desired drag at high Mach number; and so considerable development effort has been expended in reducing this high lift, high Mach number drag. The new leading-edge, which incidentally also required some redesign of the slotted portion, has met this condition. Flight tests with a plastic cap have completely verified the improved characteristics; although there was a reduction in maximum lift coefficient of the revised aerofoil, this has been completely offset by the additive effects of the increased chord and wing area; thus the new DC-8 wing has the same maximum lift capability as the original. Due in large measure to the reduced thickness/chord ratio, the drag was reduced, netting an appreciable gain in cruise speed without increased fuel consumption. Douglas say that the fully modified DC-8, when in operation, will be the fastest inter-continental jetliner of the day.

Another fascinating commentary on, and a striking confirmation of, the paramount rôle played by the wing is that in the clean-up programme to eliminate or minimize every possible

CONFESSIONAL BOXES.—Modified wing leading-edge of DC-8 has two slotted portions inboard of engine pod pylons. Slot action comprises upper and lower valved-door openings over 40% of span.

drag item, Douglas aerodynamicists finally got around to revising the chopped-off wing tips of the DC-8. By adding some 16 inches to each tip and sculpturing off some of the leading-edge bluntness (in plan view) they have arrived at a half-way approach to the fully arced Kuchemann wing tip. To be fully effective, the latter demands essentially a quadrantal arc subtended from a point on, or near, the trailing-edge, such that the leading-edge is swept back in a smooth curve to meet the outermost tip of the wing at the trailing-edge. The geometry, and indeed the aerodynamics, are simple enough and have been embedded in the research literature for at least the past twenty years, but it is just this extra pinch of finesse that seems to escape the formal aerodynamicist and his wind-tunnelling colleague. Perhaps too much squinting at slide-rule figures tends towards astigmatism when viewing the aircraft figuration.

The real purpose, of course, of the properly arced tip is to straighten out the local flow effects (and defects) induced by fore-and-aft truncation. Truncated tips reduce the effective sweep angle at the tips by bending the suction isobars forward and thus conspire to lower the drag divergence Mach. No. Arcing back the tip from leading- to trailing-edge straightens out the isobars (or pressure contours) to the designed sweep angle foci and so restores this loss. The gain may be only a secondary one, but if we assume that the increment is of the order of, say, 0.01 M, we obtain an increase in maximum cruise speed of approximately 7 m.p.h. without any corresponding thirst in fuel consumption; that is, figuratively speaking, one is not climbing up the steep rise of the drag curve, burning excessive fuel for negligible knots.

But whether this business of confession is boxed or out in the open, in freeing some of these captive truths from confinement, we get that rare bonus of "something for nothing." Which is not only good engineering, but sound commercial business—S.H.E.

Airport Red Tape

by D. N. May

"THE AEROPLANE AND ASTRONAUTICS" of Oct. 14 contained details of half a dozen new airports springing up on both sides of the Atlantic—exciting jet-generation airports where passengers are whisked about in mobile lounges or on moving sidewalks, on overhead railcars or through underground tunnels. All this is admirable in itself but what strikes one immediately is the resigned acceptance of airport red tape as a problem that is to go on for ever.

Last year the *Daily Mail* London-Paris race showed what could be achieved without red tape restrictions, but after this brief unmasking the problem has slid back into what may well be another decade of neglect. Yet, in fact, it has become more pressing with the advent of the jet age. As flying times become shorter, so the time wasted becomes more obvious and it is particularly distressing to see that the great air terminals now being built are not designed to improve the situation.

It would seem after but a cursory glance at the subject that more than just changes are required. For example five minutes saved in an overhead railcar is not much use if one spends ten minutes in Customs. And even five minutes saved in Customs is ridiculous if the next twenty minutes are spent sipping coffee before boarding the aircraft.

What is needed is a breakthrough—and it should come now, just in time to couple with the opening of these new airports to provide an almost perfect service. Allegheny Airlines have shown what can be achieved on domestic flights with their pay-as-you-board travel but there have been no comparable innovations on international flights.

Any passenger who has spent an hour or so waiting for his aircraft in the bustle of a crowded airport will agree that getting away promptly is more important than anything else. Endless waiting before the flight makes the most seasoned passengers, and even the pilots, tired and irritable, and the feeling of tenseness mingled with excitement which causes this only subsides when one is airborne.

What about putting the formalities after the flight instead of before? This is not a method of deceiving the passenger. The amount of time spent tied up in red tape can be more than halved.

First we must recognize that airport Customs are more a deterrent than anything else. They are there to dissuade the would-be smuggler rather than to collect revenue. One wonders how much of the loss British airports incurred last year was due to the expense of maintaining Customs facilities for passengers.

Suppose that the Customs officials at the port of arrival are given the authority to act not only for the government of the port of arrival but also for the government of the port of departure. Customs are in most cases such an unimportant formality that it is hardly necessary to go through them twice. And the cost of maintaining Customs would also drop. More important, the absence of Customs at departure *would enable baggage to be loaded as soon as the passenger arrives.*

The next thing to do is to abolish all other forms of checking on departure. Why shouldn't the passenger be given his seat number and baggage labels when he confirms his booking 72 hours before the flight? Similarly, there is no reason why his baggage should not be weighed on arrival as one simple operation by the Customs official. This is merely to deter passengers from carrying more than the permitted weight of baggage.

Naturally, it is no check on the aircraft's take-off weight. To ensure this is not exceeded the trolley carrying the baggage would be driven on to some scales made flush with ground-level and the weight read off in a matter of seconds. A simple deduction of the trolley's weight would give baggage weight.

A similar procedure would be adopted in the case of a mobile lounge. This would later be compared with the weight obtained by the Customs officer as a simple check. A pallet loading system would be admirable here.

The most time-wasting part of airport red tape is that abominable regulation which requires passengers to be at the airport for some international flights at least an hour before departure time. This is not dictated by the length of time necessary to complete checking-in details. If it were, one would not have to spend 20 minutes kicking one's heels in a crowded airport lobby.

It is there so that the airline knows which and how many passengers are travelling—which is the very reason passengers have to confirm their bookings 72 hours earlier. One wonders why this anomaly exists.

Airline officials are also hampered by passengers arriving over a period of about an hour during which several departures by the same airline may take place. This is rather different from the sleek "production line" efficiency of the suggested system where everyone knows exactly from where and on what flight the passenger has arrived.

PRESENT SYSTEM		SUGGESTED SYSTEM	
x—60 minutes	Baggage weight Ticket checks	*x*—15 minutes	Baggage
x—20 minutes	Customs		
x	FLIGHT	*x*	FLIGHT
x+10 minutes	Customs Baggage recovery	*x*+15 minutes	Customs Baggage Weight Baggage recovery
70 MINUTES		30 MINUTES	

A typical flight would follow this pattern. The passenger would arrive 15 minutes before departure and place his baggage on a conveyor-belt marked "Flight XYZ." He would then proceed immediately to a mobile lounge, or to the aircraft itself if this is possible. He would buy his ticket here if he has not already got one.

On arrival at his destination he would have his baggage weighed and quickly examined before walking away with it. And the total time spent at both airports would be only about 30 minutes.

Easier said than done? To a non-expert observer there seems every likelihood that this system would work. Of course its implementation would require a complete change in official thinking about Customs. Perhaps B.E.A. and Air France would try it on the Paris-London route for a year. It might result in a pretty startling increase in traffic. Later IATA could run it on an international basis.

Everyone pays lip service to international co-operation. Here is an opportunity to convert words into deeds! A very far-sighted and, I fear, *too* hopeful outcome may be the complete abolition of Customs for passengers. But that is premature.

What is possible is that the experts should be encouraged to make a start in the solution of the problems of airport red tape.

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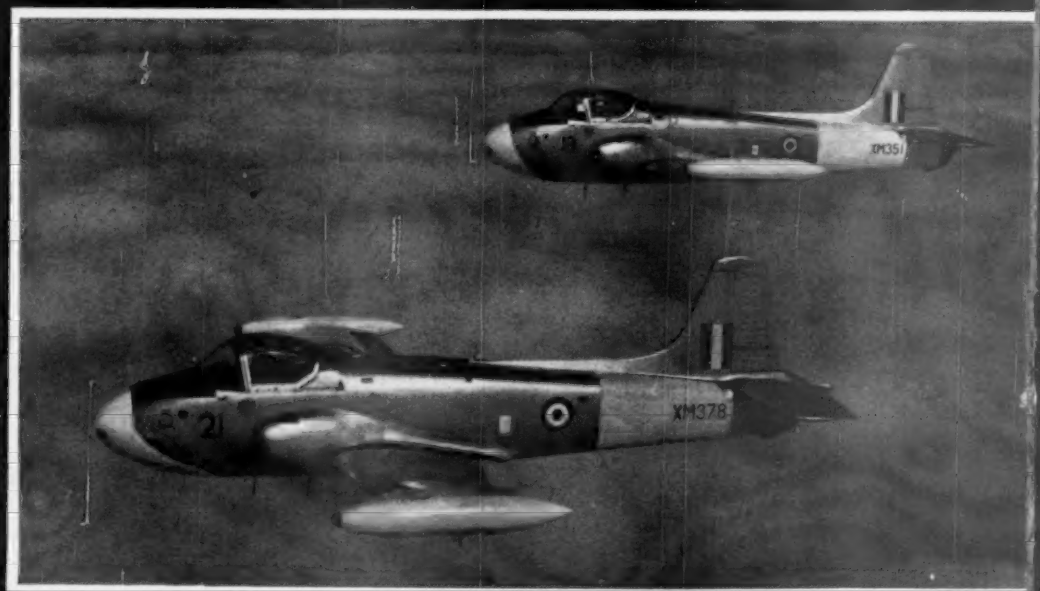

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The Fighting Services

Airborne Medical Services

RECENT developments, with an emphasis on the use of long-range transport aircraft and the large VTOL transport, were practised in Exercise "White Swan," the annual R.A.M.C. demonstration held in the Aldershot area last week. Watched by about 180 senior medical officers from the three Services and Commonwealth forces, it included R.A.F. Medical Branch personnel and a number of Transport Command aircraft.

One technique demonstrated during the exercise was the swift introduction of major surgical aid to the battlefield. Representing a considerable step forward, this was achieved by the use of a Westland (Fairey) Rotodyne to fly in, as an under-slung load, a "helipod" which opens out to form two operating theatres.

At Odiham—a simulated overseas airhead—medical personnel and their equipment were flown in by Comet, Britannia and Beverley. Some of the personnel were then transferred to the Rotodyne and moved forward to the "combat zone," the R.A.M.C. Field Training Centre at Mytchett, Aldershot, where the mobile operating centres were set up.

Interesting displays at Mytchett were a mock-up helipod containing an air-conditioned heat stroke station; and a mock-up fuselage of a military version of the Rotodyne. This was shown in a casualty carrying rôle capable of accommodating 32 stretcher and eight sitting patients.

Westland has been asked by the Ministry to tender for 12 R.A.F. Rotodynes for use in the trooping, freighting and ambulance rôles. This will be a military version of the civil Rotodyne Z designed around two Rolls-Royce Tyne turbo-props. These powerplants permit a gross weight of 65,000 lb. while retaining a high standard of performance including single engine capability.

It has a ferrying range of 1,700 n. miles and a typical pay-load of 10,000 lb. With 15,000 lb. of fuel the Rotodyne Z has a 472-mile radius of action. As freighters, 12 military Rotodynes could move 200 tons forward 300 n. miles in a 12-hr. day, refuelling only at their base.

Air Staff Appointment

AIR VICE-MARSHAL T. O. PRICKETT, C.B., D.S.O., D.F.C., is to become Assistant Chief of the Air Staff (Operations) at the Air Ministry in December of this year.

In 1954 he was appointed O.C. of No. 122 Wing, 2nd T.A.F., at Jever, and two years later completed the 1956 course at the Imperial Defence College. He then became Director of Policy (Air Staff) at the Air Ministry and in May, 1958, was appointed Senior Air Staff Officer at No. 1 Group, Bomber Command.

Night Flying

THE first night casualty evacuation by a Twin Pioneer of No. 78 Squadron took place early last month when a Serviceman suffering from acute appendicitis was flown from Mukeiras in the Western Aden Protectorate to R.A.F. Khormaksar, a distance of 100 miles.

An emergency flare plath of paraffin lamps and Land-Rover headlights was laid alongside the landing strip at Mukeiras, which stands 6,700 ft. above sea level and is situated in an enclave surrounded by an 800-ft.-high ridge. After landing safely on this difficult strip, the Twin Pioneer, flown by Sqn. Ldr. J. H. Phillips and navigated by M. Nav. F. Chaplin, was airborne again within minutes of the casualty being put on board.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. E. A. Harrop, O.B.E., to the Department of the Air Member for Supply and Organization. Wg. Cdr. R. G. Churcher, D.S.O., M.V.O., D.F.C., and Sqn. Ldr. J. E. Jacobs, with acting rank of Wg. Cdr., to the Department of the Chief of the Air Staff; Wg. Cdr. J. B. Lewis to the Department of the Air Member for Personnel.

Bomber Command: Gp. Capt. J. B. Wray, D.F.C., to Headquarters as Senior Personnel Staff Officer; Wg. Cdr. J. M. Daniel, D.F.C., to R.A.F. Wittering as Wg. Cdr. Operations; Wg. Cdr. J. A. G. Jackson, D.F.C., A.F.C., to R.A.F. Waddington to command No. 44 Squadron; Wg. Cdr. P. A. Ostle to Headquarters for organization duties.

Fighter Command: Wg. Cdr. D. R. Griffiths, D.F.C., to the Guided Weapons Range Unit, Aberporth, to command, with acting rank of Gp. Capt.; Wg. Cdr. D. F. G. Macleod to the R.A.F. Hospital, Ely, as Specialist in Dental Surgery.

Coastal Command: Wg. Cdr. E. J. Holloway, D.F.C., to Headquarters as Senior Personnel Staff Officer.

SILVER JUBILEE.—The 25th anniversary of the first flight of the prototype Hawker Hurricane on Nov. 6, 1935, takes place this Sunday. This Hurricane 2C—LF 363—of the Battle of Britain Memorial Flight was originally issued to Nos. 63 and 309 Squadrons in 1944.

Transport Command: Gp. Capt. N. Cameron, D.S.O., D.F.C., to R.A.F. Abingdon to command; Wg. Cdr. K. L. Charney to R.A.F. Christmas Island to command; Wg. Cdr. N. E. Hoad, A.F.C., to R.A.F. Lyneham to command No. 216 Squadron.

Flying Training Command: Gp. Capt. H. Z. Foreman, O.B.E., to Headquarters as Command Engineering Officer.

Technical Training Command: Gp. Capt. R. M. Hewat to the R.A.F. Hospital, St. Athan, Glam., to command; Sqn. Ldr. P. A. H. Moon to No. 4 School of Technical Training, St. Athan, to command the Boy Entrant Wing, with acting rank of Wg. Cdr.

Middle East Air Force: Wg. Cdr. F. S. R. Johnson to No. 113 Maintenance Unit, Cyprus, to command.

Other Appointments: Gp. Capt. A. A. Fletcher to the United States on exchange posting; Wg. Cdr. A. W. Eyre to the Ministry of Aviation, with acting rank of Gp. Capt.; Wg. Cdr. W. A. Smith, D.F.C., A.F.C. to Canada as Air Staff Training Officer, United Kingdom Services Liaison Staff; Sqn. Ldr. G. W. Foskett to Allied Forces Northern Europe for operations duties, with acting rank of Wg. Cdr.; Sqn. Ldr. H. R. Williams to Air Headquarters, Malta, as Assistant Director, Joint Tactical School, with acting rank of Wg. Cdr.

Cyprus Defence Exercise

THE autumn air defence exercise for Cyprus—Exercise "Jessie"—was held from Oct. 26 to 28. In addition to M.E.A.F. squadrons, units from Fighter Command, Bomber Command, R.A.F. Germany, and British Forces Arabian Peninsula took part.

Simulated raids were mounted by day and night from high and low level by the Akrotiri-based Canberras of the M.E.A.F. Light Bomber Wing. Also operating from Akrotiri were Valiants of No. 18 Squadron, and Canberras of No. 213 Squadron, R.A.F. Germany. Other raids were flown by Canberras of No. 39 Squadron, based in Malta.

Two Hunter squadrons, Nos. 54 and 65, and No. 25 Squadron with Javelin FAW.9s were stationed at Nicosia to counter the raids. No. 8 Squadron, from Aden, equipped with Hunter FGA.9s, operated in the defensive rôle from R.A.F. Akrotiri.

More Service News

A.U.A.S. Annual Dinner.—The annual dinner of the Aberdeen University Air Squadron will be held in the Royal Athenaeum Restaurant, Aberdeen, on Saturday, Dec. 3. All past and present officers and members who are interested in attending are asked to write to the secretary, Aberdeen U.A.S., Bedford Road, Aberdeen, as soon as possible.

R.A.F. Kuala Lumpur.—Service installations at Kuala Lumpur were formally handed over to the R. Malayan A.F. on Oct. 25 by Sir Geofroy Tory, the High Commissioner in Malaya. The £5 million gift was accepted by Tun Abdul Razak, Deputy Prime Minister and Defence Minister.

Australian Services.—Air Marshal Sir Frederick Scherger has been appointed the next Chairman of the Australian Chiefs of Staff Committee. Sir Frederick Scherger has been Chief of the Australian Air Staff since 1957. He goes to his new post in May next year, succeeding Vice-Admiral Sir Roy Dowling, who is retiring.

Cheaper Upper-air Research

ONE of the difficulties of establishing a co-operative programme of upper-air research among the nations of Europe, as recently urged by the European Space Research Study Group (THE AEROPLANE AND ASTRONAUTICS, Oct. 21, 1960, p. 563), is the fact that only a few of them have suitable rocket hardware. Britain, of course, has the tower-launched Skylark (Ref. 1) which has performed reliably at Woomera since 1957 carrying research instruments to a maximum height of about 100 miles. The altitude reach of this particular vehicle is now being increased by the addition of an R.P.E.-developed Cuckoo booster (Ref. 2). Black Knight is also being pressed into service as an upper-atmosphere research vehicle.

In France, the Véronique sounding rocket has been developed by the *Laboratoires de Recherches Balistiques et Aérodynamiques* at Vernon. First firing of the type N was made as early as 1950 from a site in France. Latterly, firings have been made from Columb-Béchar, the French rocket range in Algeria.

In 1959, Véronique achieved a record altitude of 111.6 miles. Payload of the latest variant is 116 lb. and the planned altitude 140 miles. The rocket has undergone considerable development since it was introduced and furfuryl alcohol and oil of turpentine have been used as fuels in place of diesel oil; the oxidant remains white fuming nitric acid.

There has been a suggestion that the three-stage solid-propellent Monica upper-air research rocket may eventually be mated with Véronique to attain much higher speeds and/or altitudes. As a research vehicle in its own right, Monica 5—the latest of five models—is designed to carry a 33-lb. payload to a height of about 100 miles.

The Italians have been firing small research rockets of their own manufacture from a launching site in Sardinia. For the rest, it seems likely that they will have to rely on rockets obtained from elsewhere, the most likely source being the United States. It is known, for example, that the Swedish National Committee on Space Research is anxious to obtain rockets for launching from a site close to the Geophysical Observatory at Kiruna, within the Arctic Circle.

American Sounding Rockets

One of the vehicles proposed for this work is the American Arcas sounding rocket. It would be used for investigating the structure of the atmosphere and measuring electron-density at altitudes of between 18.6 and 49.7 miles.

Arcas is a 6-ft., 72-lb., single-stage solid rocket originally developed for use in meteorological and upper-air research by the U.S. Navy's Office of Naval Research. It is one of a series of sounding rockets produced by the Atlantic Research Corporation of Alexandria, Virginia.

The high-energy aluminized rocket propellent used in the Arcas motor is designed as an end-burning grain with a long thrust duration (total impulse 9,940 lb./sec.). It will lift a 12-lb. payload to an altitude of about 40 miles. The nose cone of the rocket is separated near the peak of the trajectory and landed by parachute.

A feature of the Arcas system is its inherent simplicity. Firing is made from a closed-breech launcher which utilizes the initial exhaust-gas pressure built up by the rocket; in this way the launcher expels the rocket at a higher velocity than could otherwise be achieved.

By means of azimuth and elevation adjustment, the launcher can aim the rocket within a 20° vertical cone. It consists of five major parts having a total weight of 390 lb., and can be assembled by two men in two hours.

A meteorological rocketsonde has been developed for the Arcas rocket. This employs a parachute designed to lower a 6.5-lb. payload from 200,000 to 80,000 ft. at a descent rate which permits the measurement and telemetry of meteorological data between these levels. The sonde is prepackaged in a split plastic shell housed in a 10.75-in. extension of the forward end of the rocket motor.

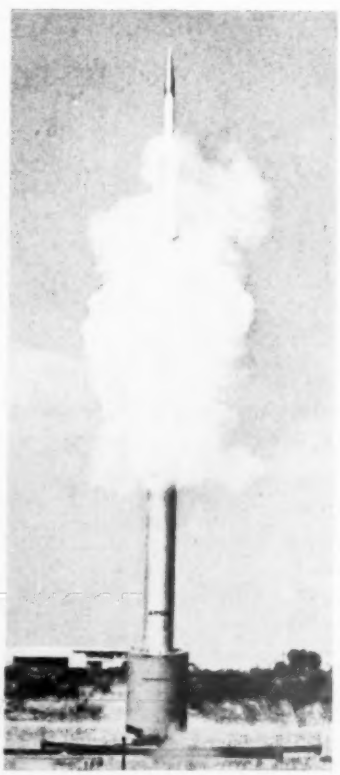
Further development of the Arcas system is currently taking place which should extend still further its capabilities. A longer launcher is being produced to raise the launching velocity to over 200 ft./sec., while maintaining low accelerations. A glass-fibre motor tube is under development with the aim of improving the mass-ratio. Attempts are also being made to reduce cost by refinements in propellent extrusion, permitting quantity production of the propellent grains.

Attention is also being paid to the possibility of launching Arcas rockets from balloons and aircraft, and to the development of multi-stage vehicles.

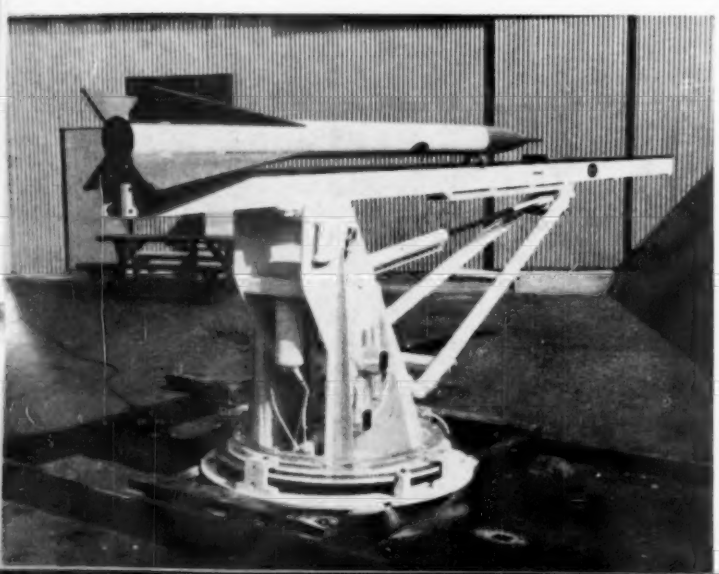
More advanced payloads are also being devised, including a Videosonde system designed by Atlantic Research in conjunction with its subsidiary, Jansky and Bailey, Inc. This will incorporate a light-weight, low-cost, expendable TV camera capable of transmitting a continuous picture from an altitude of 200,000 ft. down to 70,000 ft. at standard meteorological radiosonde frequencies.

At peak altitude, a small parachute will be deployed to orientate, stabilize, and lower the camera while it is transmitting a picture of the lower atmosphere and the Earth's surface, to a ground receiving station. This technique promises to be less costly than a system employing a conventional film camera and requiring recovery support activity.

Arcas is actually the smallest in the series of sounding rockets produced by the Atlantic Research Corporation. The 6-in.-dia. Arcon is designed to carry a 40-lb. payload to an



Right, an Arcas sounding rocket soars from its launcher at Elgin A.F.B., Florida. The white objects falling away from the sides are plastic spacers used to steady the rocket as it is launched. Launcher is a portable, closed-breech unit in which gas pressure from the rocket's exhaust is used to impart additional acceleration.



An Asp sounding rocket mounted on an adjustable launcher.

altitude of 61 miles, and the 12-in. dia. Iris is intended to carry 100 lb. to an altitude of 190 miles. Apart from size, all three rocket types have similar solid-propellent motors and configurations.

Tower-launched from NASA's test facility at Wallops Island, Virginia, on Jly. 22, 1960, the first Iris reached an altitude of 140 miles carrying a 150-lb. payload. It was launched by a combination of the Iris long-burning motor and a solid propellent boost-cluster of seven small rockets producing about 20,000 lb. of thrust. The booster drops off a few seconds after launching leaving the integral Iris motor to accelerate the rocket to about 6,774 ft./sec. at burnout; the motor has the exceptionally long burning time of about 62 sec.

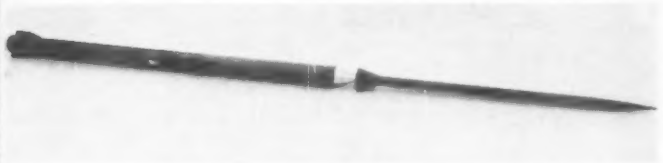
Although Iris is a comparatively large rocket (225.8 in. long by 12.13 in. dia.) it is comparatively inexpensive—costing less than half the price of earlier rockets with the same payload/altitude capability.

Arcas is at present being produced at a rate of 100 per month and Iris is in the midst of qualification firings.

Although Arcon has been in use for many years, a contract for an improved, "aluminized" Arcon has recently been received from the National Aeronautics and Space Administration. Meanwhile, Arcas is in regular use by the military services, and by NASA. It is also used as the rocket vehicle for MetNet, an integrated and synchronized meteorological network in the United States and Canada.

Loki Development

Another sounding rocket of some interest is the Roksonde, produced by Cooper Development, a division of the Marquart Corporation. This vehicle, and its launching system, was originally developed for the Office of Naval Research to supply meteorological information during the nuclear tests in the Eniwetok-Bikini area. The vehicle itself was based on the Loki close-support anti-aircraft rocket developed by the Jet Propulsion Laboratory, and consists of a rocket booster, a



The Roksonde meteorological probe which employs a Loki-type boost rocket and a coasting "dart."

dart projectile, and a fuse-ogive assembly. Fired from a tubular launcher, the booster and dart separate because of drag differences at burnout (approximately 4,000 ft.) and the dart projectile coasts to over 100,000 ft.

After a predetermined time the fuse ignites an expelling charge and the payload of aluminium chaff ("window") is expelled. This forms a radar-reflective, wind-sensitive target, which can be tracked by ground stations to provide a wind profile as the chaff descends.

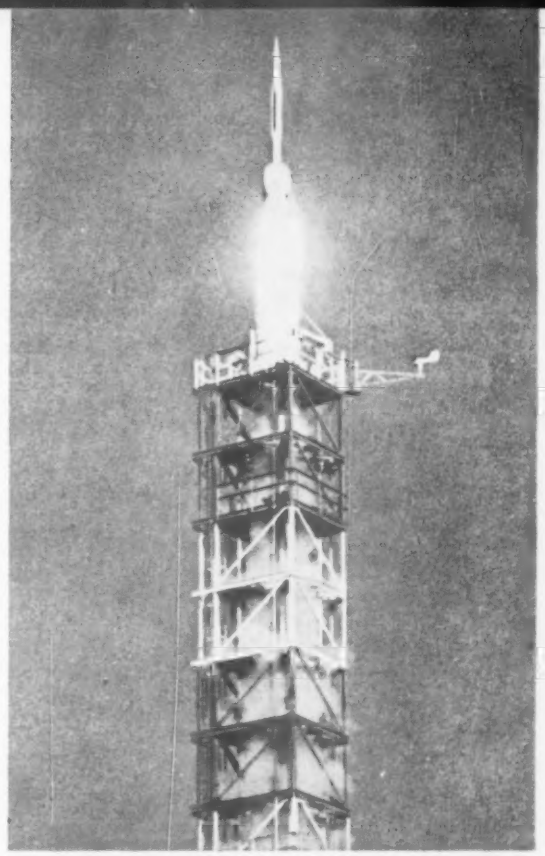
Subsequently, a number of different wind-sensing payloads has been evaluated. These include metallized chaff, metallized parachutes and self-inflating metallized spheres.

Studies are now being made into higher performance rocket motors and larger dart projectiles. The 1.375 in. dart most commonly used has a payload volume of 24.8 cu. in., and peak altitudes of 230,000 ft. are achieved with an RM 2210 booster, launching at sea level. It is expected that increased volume and payload capabilities will permit research investigations to be extended to include measurements of ozone, dew point, radiation and other parameters at increased altitudes.

A variant of the Roksonde system is the Hasp, which is fired from a 5-in. gun instead of a tubular launcher. Otherwise, the two systems are identical. The Hasp has fixed shoes attached to the rocket motor fins and separable bore riders attached to the dart fins.

Sampling "Nuclear" Clouds

Asp is another high-performance solid-propellent rocket by the Cooper Development Corporation; it was first launched at the Naval Air Missile Test Center, Point Mugu, California, in December 1955. Its original purpose was to measure and telemeter back to ground stations data on radioactivity in the interior of clouds resulting from nuclear test explosions (Ref. 3). Other specially developed payloads collected and recovered samples from similar clouds, while others, launched during the height of solar flares, have been used in I.G.Y.



IRIS leaves the launcher during its initial firing at Wallops Island last July. It ascended 140 miles.

programmes to measure solar radiations and changes which occur in the atmosphere.

The current Asp IV is capable of carrying payloads of 10 to 85 lb. to altitudes of 300,000 to 550,000 ft. Launching is accomplished from a portable, single-rail, launcher.

Propellent is a polysulphide-ammonium perchlorate composition, with an internal burning tapered cylindrical perforation. The grain is cast in the thin-wall welded steel case with a polysulphide liner. Gross weight of the Asp model C rocket motor is 187 lb., empty weight 40 lb.

Conclusion

From the above it can be seen that a wide range of low-cost rocket vehicles has become available in the United States which might readily serve the needs of the smaller nations interested in starting their own research programmes. There are, of course, examples of other high-performance rockets.

ARCAS PERFORMANCE DATA

Nominal payload	12 lb.
Maximum altitude	210,000 feet (40 miles)
Time to maximum altitude	128 sec.
Altitude at burnout	47,300 feet
Maximum velocity	3,652 ft./sec.
Acceleration at launch	40g.
Launch velocity	150 ft./sec.
Total rocket weight (including payload)	77.0 lb.

ARCAS ROCKET MOTOR DATA

Thrust	350 lb.
Burning time	28.4 sec.
Total impulse	9,940 lb./sec.
Propellent	Arcite 373D
Length	60.8 in.
O/D	4.45 in.
Wall thickness	0.040 in.
Weight	64.5 lb.
Nozzle throat area	0.196 in.²
Nozzle exit area	2.550 in.²
Expansion ratio	13:1

ASP IV TECHNICAL DATA

Gross launch weight (without payload)	205.0 lb.
Burnout weight (without payload)	50.0 lb.
Maximum acceleration (with 50 lb. payload)	27g.
Ignition	6 volts D.C.
Motor burning time	12.7 sec.
Payloads (including nose cone):	
Weight range	10 to 85 lb.
Diameter (nominal)	6.5 in.
Length (nominal)	65 in.

such as the two-stage Nike-Asp, which employs a booster of the type originally developed for the Nike-Ajax surface-to-air missile. Indeed, the Italians are reported to be negotiating the purchase of this rocket from NASA.

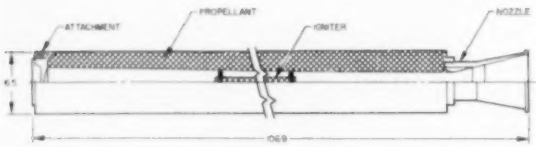
In closing, it should be mentioned that a most effective development of the British Skylark has been made by Bristol Aerojet Ltd., for manufacture in Canada under the name of Black Brant. This rocket is being launched from Fort Churchill in the province of Manitoba.

References

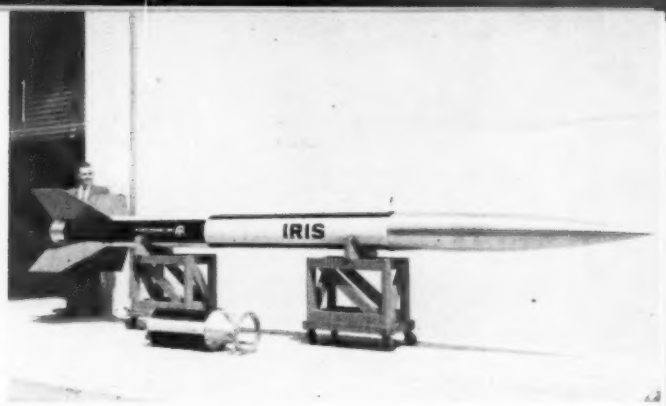
(1) "A British Rocket for the U.S.," THE AEROPLANE AND ASTRONAUTICS, Feb. 26, 1960, pp. 256-257.

(2) "Rockets and Satellites Discussed," THE AEROPLANE AND ASTRONAUTICS, Mar. 18, 1960, p. 348.

(3) "Sounding Rockets," Ed. Homer E. Newell, McGraw Hill Book Co. (1959).



Sectional drawing of the ASP Model C rocket motor which has a gross weight of 187 lb.; empty weight 40 lb.



Close-up of the 20 ft. long, 12 in. dia., IRIS sounding rocket which can carry 100 lb. of instruments to an altitude of 190 miles. In the foreground is the seven-rocket cluster—total thrust 20,000 lb.—which boosts IRIS from its launcher.

ROCKET MOTOR DATA

	ARCAS	ARCON	IRIS
Peak altitude (ft.)	208,500	323,400	995,800
Peak altitude (miles)	39.5	61.1	188.6
Nominal payload (lb.)	12	40	100
Payload range (lb.)	5–15	15–40	75–200
Payload volume (in.^{3})	310	1,010	7,150
Rocket length (in.)	92.3	154.0	225.8
Rocket diameter (in.)	4.45	6.10	12.13
Rocket weight (lb.)	64.5	213.1	1,128.7
Total impulse (lb.-sec.)	9,940	31,185	207,000
Thrust (lb.)	350	945	4,510
Burning time (sec.)	28.4	33.0	45.9
Maximum velocity (ft./sec.)	3,652	5,426	7,286
Maximum acceleration (g.)	30	10.5	12.8

Comparison of three sounding rockets produced by the Atlantic Research Corporation.

Towards Bigger Boosters

AS we reported briefly last week, the National Aeronautics and Space Administration has selected three American companies to begin preliminary design studies of "super-size" solid-propellent rocket boosters for space application. The companies concerned are Aerojet-General Corp., Grand Central Rocket Co. and the Thiokol Chemical Corp.

Grand Central will work on the design of a solid first stage for vehicles in the one million lb. class. Thiokol will consider a similar first stage in the seven million lb. class; and Aerojet-General is to conduct studies of boosters in both weight ranges. Thrust levels will be two to three times the vehicle weight.

The new studies are the outcome of investigations made last year by the Lockheed Aircraft Corporation and the Aeronutronic Division of Ford Motor Co., which each undertook studies for NASA on the potential advantages of large solid boosters. This separate work, however, was not concerned with formulating specific designs but dealt with the general performance capabilities of solid engines.

In addition to laying out designs for first-stage solid boosters, the three companies will also look into the design of liquid-propellent upper stages in order to obtain realistic assessments of overall vehicle performance. The studies authorized by NASA will be carried out over a six-month period at a total cost of about $225,000.

Lunar Navigation

A UNIQUE one-day symposium on "Navigation and the Early Exploration of the Moon" is being held on Nov. 18, 1960, under the auspices of the Institute of Navigation and the British Interplanetary Society. The meeting, which opens at 10.00 hrs. at the Royal Geographical Society's House (entrance in Exhibition Road), London, S.W.7, brings together speakers from the United States and Gt. Britain. The papers to be presented are as follows:—

"The Demands of Nearby Parabolic Lunar Trajectories on Differential Correction and Perturbation Theory," by Dr. Samuel Herrick, University of California, Los Angeles, and Aeronutronic (a Division of Ford Motor Co.); "Guidance of Space Vehicles by Radio Measurements and Command," by A. R. Maxwell Noton, University of Nottingham; "The Rôle of Inertial Equipment in Lunar Flights," by D. J. Cashmore, English Electric Aviation, Ltd.; "Comparison and Implementation of Rendezvous Methods," by Dr. G. R. Arthur, General Electric Company, U.S.A.; "Surface Navigation on the Moon," by P. A. E. Stewart, Hawker Siddeley Aviation, Ltd., Advanced Projects Group; "Fuel Requirements for Mid-course Corrections during Return from Manned Lunar Flights," by H. L. Bloom, General Electric Company, U.S.A.

Application forms obtainable from the Secretary, British Interplanetary Society, 12 Bessborough Gardens, London, S.W.1. Admission is free to members of the organizing groups; a registration fee of £1 will be charged to non-members.

Boost for Dyna-Soar

WORK has begun at Aerojet-General, in Azusa, California, on the modification of the Titan ICBM rocket engines to permit their use in the initial Dyna-Soar booster. Early test launchings of the boost-glider at Cape Canaveral will depend on two-stage Titan boosters to lift the vehicle to near-orbital speeds.

Aerojet has received a contract to modify both the operational type YLR87-AJ-3 and YLR91-AJ-3 engines. Few basic changes are planned because of the engines' proven reliability in ICBM test firings. One significant addition, however, is the provision of monitoring circuits to permit ground stations, the Dyna-Soar pilot or an automatic pilot system to be aware of changing conditions of engine operation and have control of the power unit.

Other modifications include provision of a system to ignite the second-stage engine prior to separation in view of the fact that the mated Dyna-Soar would be unstable at this stage without the thrust and gimbal-control available from the second-stage engine. In the standard Titan a coasting period intervenes between separation and ignition of the second stage.

Aerojet-General are stated to have more powerful boosters in the planning stage which will permit full orbital flights by the projected manned glider.

Soviet Lose their Rocket Chief

MARSHAL NEDELIN, 56, the Soviet deputy Defence Minister and chief of the Russian rocket forces, was killed in an air crash on Oct. 4. He is succeeded in both posts by Marshal Kyril Moskalenko.

It was after the U-2 incident that Marshal Nedelin was appointed chief of the Soviet rocket forces. On May 30 he was ordered by Marshal Malinovsky to strike at the base of any aircraft which henceforth infringed Soviet airspace or that of any other communist country.

A Hero of the Soviet Union, Marshal Nedelin fought in the battle of Moscow during World War II. Later, he became colonel-general of the artillery and was promoted marshal of artillery in 1953.

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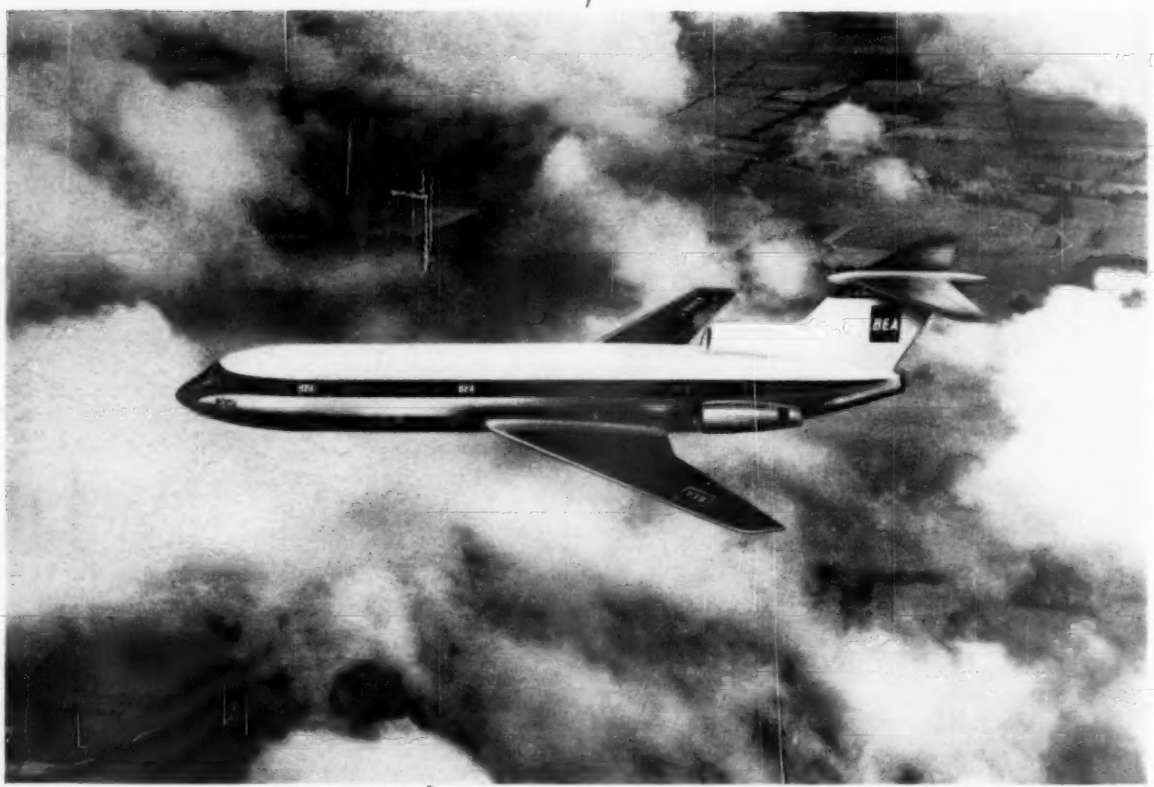

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Flying the Scheibe Sperling

By John Fricker

With the 90- or 100-b.h.p. Continental, the Sperling is fully aerobatic with two people on board. It has a wooden Hoffman propeller.

GERMANY has always been an air-minded nation, and since the ratification of the Treaty of Paris the Federal Republic has seen the growth of a flourishing aircraft industry. There is a vigorous flying club and gliding movement, which is catered for by several small companies, and these tend to produce both powered and motorless light aircraft, unlike the majority of their specialized foreign contemporaries.

One of the most active of the small German companies is Scheibe-Flugzeugbau, of Dachau, near Munich. This produces a great variety of sailplanes, and has also developed a couple of powered types, including a classically orthodox club trainer, the SF-23 Sperling (Sparrow). About 20 of these two-seaters have so far been built, and an example was recently brought to this country by Alexander von Bismarck, the veteran German aviator who began flying in 1913 and is still an active pilot.

Well known from pre-War sporting flying activity, Herr von Bismarck was accompanied by Herr Medicus of the Scheibe company during his visit, which provided an opportunity to fly the Sperling at Panshanger. First, however, Herr Medicus demonstrated the fully aerobatic nature of the sprightly Sperling in a solo show of prolonged spins, loops and rolls which indicated an unusual degree of manœuvrability for a high-wing aeroplane.

Dual aerobatics were not possible in the visiting SF-23C Sperling, D-EMOH, because of the weight penalty associated with the installation of its 115-b.h.p. Lycoming O-235-C1 engine, which is primarily intended for glider towing. Normal powerplant of the Sperling is the 90-b.h.p. Continental C90 (SF-23A) or the 100-b.h.p. Continental O-200A (SF-23B), both of which present no limitations on dual aerobatics for training.

The simple cockpit of the Lycoming-powered SF-23C Sperling with its flat-topped and low-set front coaming.

In its general conception—steel-tube fuselage and tail structure, fabric covering, powerplant and overall layout—the Sperling corresponds quite closely with our own two-seat Auster D.4, except for its wooden-framed wing and aerobatic capability. Its airframe is obviously sturdy and should stand up to hard treatment as well as the long-lived Austers do, while the entire aircraft is simple and straightforward.

This is apparent from the elementary front panel, which has only basic metric instruments plus a V.S.I., although no turn-and-slip. Entry into the cockpit is via a small door on each side without assistance from a step, but the single bracing strut facilitates access. A baggage compartment behind the fixed seats takes up to 66 lb. of kit and the seat-frames have removable rear squabs to accommodate back-type parachutes. Full shoulder harness is provided.

Being short-legged, I had to strain a little to achieve extreme rudder-pedal movement, which I also remember as a feature of the Austers. The resemblance between those and the Sperling extends to the heel brake pedals on the port side, but the cowling line of the German aircraft is considerably lower and flatter, and the forward view is better because of the narrower instrument panel. The ground angle of the Sperling is also less, which improves taxi-ing visibility.

Interior furnishings are considerably more Spartan than in the new Austers, but there is an equally generous amount of room. The Sperling makes great use of bell-crank levers, and two of these, large, brightly chromed and projecting from the instrument panel, misled me for a moment from their true functions of dual throttles. Another bell-crank between the seats operates the elevator tab, but its odd shape makes guessing its true position initially difficult.

The dual control columns are cranked out from a single control pivot, which again makes their neutral point slightly hard to assess. Also between the seats is the lever for the split flaps, which are not fitted to some of the lower-powered Sperlings.

In front of the left-hand seat is the three-position selector for the two 40-litre wing tanks (17½ Imp. gal. total), with their eye-level glass-tube gauges. Farther left still is yet another bell-crank for the glider-hook release.

During a check circuit with Herr Medicus, before going off on my own, I took the opportunity to explore the spin characteristics of D-EMOH. Entry, on his recommendation, was by smoothly crossing the controls plus full aft stick at 100 km.p.h. (62 m.p.h.) some time before the stall. The Sperling rolled over very smartly into a fast and steep autorotation at a steep attitude, but proved responsive to normal recovery action.

During recovery, a fairly steep dive resulted in a moderately large height loss for a little aeroplane. In the pull-out, the Sperling accelerated to 230 km.p.h. (143 m.p.h.), which gave a fair margin before V_{ne} of 260 km.p.h. (161 m.p.h.). The spins did not differ appreciably in either direction.

In keeping with its utilitarian nature, the Sperling had a fairly robust noise level from the high-revving Lycoming. This develops its maximum power at 2,850 r.p.m. and, in D-EMOH, drives a metal propeller instead of the wooden type fitted to the Continental versions. As I had found during the previous week in the Cessna 182, the throttle was spring-loaded to open, which necessitated fairly tight pressure on the friction nut to prevent creep.

Before take-off, when flying solo, I checked neutral elevator trim and the first position of flap extended, and with no parking catch on the brakes to worry about, opened up to full power

into wind. There was virtually no tendency to swing and the steerable tailwheel, which had proved very effective when taxi-ing, gave adequate directional control before the rudder took over. A fair amount of forward stick was necessary to raise the tail, despite the shallow ground angle resulting from the short mainwheel legs.

After a short run the Sperling climbed very briskly away at 100 km.p.h. (62 m.p.h.), indicating 5 m./sec. (984 ft./min.) when solo, compared with the 3½ m./sec. (688 ft./min.) during the dual trip. In the air, the Sperling had a typically "Continental" feel, with lighter-than-usual ailerons well harmonized with the other controls. It did not seem very stable longitudinally in the climb, but was otherwise similar in handling to most aircraft of its class. A representative power setting of 2,350 r.p.m. returned a cruising speed of 160 km.p.h., or almost exactly 100 m.p.h.—again precisely what one would expect.

I did not have a great deal of time for aerobatics, but the Sperling went cleanly round a loop or two from a dive to 200 km.p.h. (124 m.p.h.). Rolls from a similar speed were rather barrelled, which seems inevitable with a high-wing aeroplane, but at all times during aerobatics engine r.p.m. stayed comfortably within limits.

A clean stall, power off, showed a slight port-wing drop at the 70-km.p.h. (43-m.p.h.) breakaway, while with full flap and some power there was a fairly marked roll tendency to port at about 60 km.p.h. (37 m.p.h.). Warning buffet was slight. Flap lowering was accompanied by a slight nose-down trim change, although the out-of-trim loads are naturally never large.

This applies also during the full-flap glide approach, when with full aft trim there is a small residual nose-down tendency which increases the stick-free speed to about 15 km. above the optimum 100-km.p.h. figure. Although not apparently large in area or extension, the flaps are surprisingly effective in steepening the approach path.

The elevator remains responsive for the round-out and with the small ground angle makes three-pointing a painless process. The rubber-sprung undercarriage copes with rough turf without undue harshness, and the landing run is short.

From my brief acquaintance with the Sperling I found it a robust and unpretentious little aeroplane which would seem to be an excellent club trainer for the classic type of flying. It offers nothing new, but its aerobatic capability gives it a useful versatility. Its price in Germany of 27,000-29,000 DM, or around £2,300-£2,500, according to powerplant, is very close to comparable types elsewhere.

For glider-towing, the Scheibe Sperling is produced with a 115-b.h.p. Lycoming engine, a metal airscrew, and an attachment hook above the tailwheel leaf-spring.

Manufacturers' Specification

DIMENSIONS.—Span, 32.5 ft.; length, 20.4 ft.; height, 7.3 ft.; wing area, 131 sq. ft.

WEIGHTS.—Empty (Continental engines), 1,014 lb.; (Lycoming), 1,058 lb.; useful load, 596 or 552 lb.; aerobatic, 1,500 lb.; max. gross, 1,610 lb.

PERFORMANCE (90-b.h.p. Continental in parentheses): Max. speed, 138 m.p.h. (131 m.p.h.); cruising speed, 60% power, 105 m.p.h.; initial climb, 785 ft./min. (710 ft./min.); service ceiling, 18,000 ft. (16,400 ft.); take-off run to 50 ft., 460 yd. (490 yd.); landing run from 50 ft., 350 yd.; cruising range, 394 miles (420 miles); endurance, 3.5 hr. (4 hr.).

Gliding Notes

by Dr. A. E. Slater

FRONTS, glider pilots, for the use of, are multiplying. Cold fronts were first exploited in 1929; and occluded fronts, which are much the same thing except that the air on both sides comes from Arctic regions, can occasionally be used, as in the British Nationals of 1938. Then, a few years ago, came the Los Angeles "smog front," which moves inland like a sea breeze and provides a belt of up-currents for the glider pilots of El Mirage.

Now we have the "Marfa dew-point front" which Harland Ross writes about in *Soaring*. Marfa is a small country town in the lower Rockies at the western end of Texas, 35 miles from the Rio Grande del Norte; and the dew-point front is the boundary between moist "maritime tropical" air flowing in from the Gulf of Mexico till it gets stopped by the Rockies, and dry "tropical continental" air sitting over the south-west United States.

The front is usually marked by a line of cumulus clouds which can stretch for hundreds of miles. Harland Ross was towed to it in his R-6 from Odessa, 122 miles away in stable air. He met the front 75 miles north of Marfa, to which the cloud street extended southwards, while to the north it continued over the horizon and beyond.

It was not a continuous street. And the tug pilot, evidently not a gliding man, chose to cross the dew-point front at a place where the nearest cumulus cloud was five miles away.

However, Ross was saved by a couple of buzzards who showed him where to go. Unfortunately, the front did not point due north to his goal at Clayton, New Mexico, but led him 30° west of it, so he missed a new goal flight record.

Once up to the clouds, whose bases were at 13,000 ft., all went well, with hardly any need to circle. Cross-country speed averaged 76.7 m.p.h.

Farther north, the frontal "convergence" zone expanded from 25 miles to 100 miles across, and the clouds became more sparse with an average gap of 20 miles between, which Ross crossed in under 13 min. After avoiding some thunderstorms, he climbed in a big cumulus to 21,800 ft., collected ice, glided from it at 105 m.p.h., went into a horrid yaw at 14,500 ft., when the ice came off one wing but not the other (which held it till 13,800 ft.), and finished up at Farley, New Mexico, after flying 365 miles along the dew-point front in 5 hr. 40 min.

The distance and altitude each earned him a Diamond. So now Harland Ross is the 14th pilot in the United States, and 116th in the World, to add three Diamonds to his Gold "C."

The cause of the dew-point front seems to be simply that the two air masses push against each other, and the moist one, being on the move, does the necessary escaping upwards.

* * *

A SERIES of 250 photographs of a wave cloud was taken at half-minute intervals by R. W. Dillon, meteorological officer at R.A.F. Pershore. They would make a good "time-compression" film. The cloud, described by him in *Weather*, was west of Pershore; it extended roughly N. and S., lying obliquely to a N.W. wind blowing directly from the Clee Hills in Shropshire, 28 miles away.

These hills also run N. and S., and are about 10 miles long, rising to two peaks: Brown Clee (1,790 ft.) and Titterstone Clee (1,749 ft.). They are useful as a staging post for cross-country pilots from the Midland Gliding Club, who can wait in their slope lift for a second thermal if the first one lets them down.

Although Mr. Dillon photographed it only between 13.55 and 16.05 hrs., the cloud lasted most of the day, from 07.00 to 18.30 and then from 09.45 to 17.00; but although it shifted a little and changed shape now and then, it never divided into two distinct portions corresponding to the two Clee Hills.

Moreover, it was 20 miles long—twice as long as the hills—when a Canberra flew over it at 14.17 hrs. This is not the first time that a wave cloud in the region of the Midland Gliding Club has extended laterally far beyond the width of any hill which could have caused it.

The Canberra also reported that the cloud base, though flat, was at 12,500 ft. at one end and 14,000 ft. at the other; also that its top, at 16,000 ft., was shaped like a mushroom (presumably excluding the stalk), and that there was no turbulence.

Weather charts showed an anticyclonic ridge over England, and upper air figures from the nearest radio-sonde at Liverpool showed an inversion at 6,000 ft. (cumulus-top level) and another stable layer at the height of the wave cloud. The wind direction was unchanged all the way up to 45,000 ft., but increased rapidly with heights up to a jet stream blowing at 109 knots at 34,000 ft.

So there was plenty of wind shear, as required by theory. Applying Dr. Dick Scorer's formula, which gave a wave length of seven miles, Mr. Dillon decided that his cloud was in the fourth lee wave, though no other wave clouds were visible. There was no flying that day at the Midland Club.

Correspondence

Business Aircraft on Show

THE photographic report by Howard Levy and Henry Artof (THE AEROPLANE AND ASTRONAUTICS, Oct. 21) entitled "Business Aircraft at Los Angeles" was greatly appreciated, so much so, that I wonder whether you could make this a regular feature.

Maybe it would inspire British designers to greater efforts. In fairness to British designers, and the British Isles, we must take into consideration that the U.S.A. is a vast country with equally generous resources, but the past has already shown what British designers can do in the field of aviation.

The Rover Turbo-prop seems ideal for almost any light aircraft conversion and I am looking forward to seeing the Currie Wot biplane in flight with this installation as soon as you are able to publish the photographs.

Billesley, Birmingham. MAURICE AUSTIN.

Points, Please

HAVING read and enjoyed THE AEROPLANE almost from time immemorial, as much for its technical excellence as for the purity of its English, I was pained and shocked to read on page 515 (Oct. 14) a reference to "Gapan Liverymen" and to a "Gapan Court."

You rightly refer to "The Livery" and to "The Master." Why then is The Guild referred to as "Gapan"? Are you putting us in the same category as TACAN—a useful aid but quite devoid of the dignity and prestige associated with The Guild?

True, certain ill-instructed persons refer to B.O.A.C. as "Bowack." True also that the late Founder-Editor [C. G. Grey] after a visit to the U.S.A. adopted for a while the unfortunate practice of referring to aeroplanes as "ships"; but we must regard this as a temporary lapse.

I trust that these regrettable references to The Guild come within the same category. Gapan indeed!

Cheltenham, Glos. DON L. BROWN.

Biological Licence

I REALLY feel that Mr. Dorman (THE AEROPLANE AND ASTRONAUTICS, Oct. 14) should stick to history and leave obstetrics alone. By no stretch of the imagination, juggling with figures of speech, poetic licence, metaphorical writing, can identical twins be born of different mothers. Without going into bees and fish and cross-pollination may I point out that identical twins can be produced by the splitting of one egg.

Anglesey. "DAI BACH."

"The Flying Years"—1

AN item for the co-ordinated list of inaccuracies in "The Flying Years."

In the first programme, Sir Alan Cobham said it was doubtful if Cody's plane ever flew properly at all. I cannot recall that the commentary mentioned the dates of any of Cody's flights, but if Sir Alan was referring to the Cody experiments of 1908, the B.B.C. should be told that the Royal Aircraft Establishment is sufficiently confident that Cody flew on Oct. 16, 1908, to have the fact recorded on a plaque on Cody's tree. Apart from this, Cody, of course, made a number of highly successful flights up to his death in 1913.

Farnborough. A. BRAY,
(Deputy Librarian, R.A.E.).

"The Flying Years"—2

AS one who does not claim to be an air historian and, therefore, not likely to be irritated too much by errors of detail (although capable of being disturbed by all the distortions mentioned by Mr. Hardy), I should like to add some observations to those already printed in your pages. Although Henry Ford once went on record as roundly declaring that history is bunk, many people—and I am one of them—would not entirely agree. The history of development in various modern technologies, for example, is as fascinating and educational a subject as one could wish for. And when it comes to the history of events that have taken us from the earliest days of flying to the present age of supersonic travel and aerospace missiles, there can surely be no more stimulating a story.

To me, at least, "The Flying Years" has so far failed completely to stimulate any sort of reaction beyond despair. I have been left with an impression of a breathless array of seemingly disconnected and disjointed snippets of information interleaved with all-too-brief appearances of those who have helped to make aeronautical history. Certainly it does less than justice to a story which is as majestic as the heavens which form its backcloth.

Surely such a subject calls for a documentary on the grand scale. What a pity the B.B.C. failed to provide it.

London, W.1. "PERFECTIONIST."

Groundabout

Everybody's delighted that a benevolent Medical Board gave Bill Bedford's broken ankle a C. of A. (in a special "tethered aircraft" category) to allow him to make the first "flight" in the Hawker P.1127. He'd waited a long time for a prototype to succeed the faithful Hunter and feared he'd miss it when his third passenger accident in a car busted his starboard ankle. Now, instead of a mouthful of a design number that sounds like an R.A.F. requisition form, Sir Sydney Camm's revolutionary device should get a name. Hawker Hopper? Harrier? Hostile?

*

The Downs and the Ups. The soothing music that's broadcast in airliners can be pretty unsoothing if it's not selectively selected. But perhaps it was just an employee under notice who chose the recording heard by a friend taking off from New York for the Atlantic crossing to London. He recognized the old song, "How deep is the ocean?" and was not entirely comforted by knowing that the next line was "How high is the sky?"

*

Cownie's Corner. Another one from the American diary of our staff missileer Jim Cownie. A side-light on inter-Service rivalry—the U.S.A.F. is obviously bothered by the success of the Navy Polaris programme. A U.S.A.F. general at San Francisco said, tongue in cheek perhaps, that Skybolt carried by a long-endurance aircraft could be considered "a kind of airborne Polaris, perhaps."

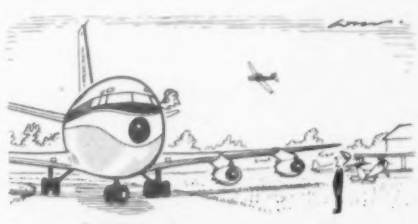
*

Three black mice, three black mice,
Don't they have fun! Don't they have fun!
They all went up into outer space
And returned alive to a watery place
Which saved the face of the Western race,
Those free black mice.

*

The Little Knowledge. When a Flight Progress Report was passed among an Electra's passengers, one of them noted the air speed, 330 knots, immediately demanded to see the captain and accused him of exceeding the aircraft's present 225-knot limitation. The captain's explanation of the difference between Indicated and True Air Speed left him unconvinced and looking uneasily out of the window. Obviously not one of you clever lot.

*



"ELSTREE? Are you Sure?"

by Gorem

Industry Record

Telemetry Exploitation

A consortium of five electronics manufacturers has been formed, on the recommendation of the Ministry of Aviation, to exploit the overseas and U.K. markets for a major air-to-ground multi-channel telemetry system developed by the member companies in collaboration with the R.A.E. Farnborough. In operational use, the system was displayed by the R.A.E. at the S.B.A.C. Show in September of this year.

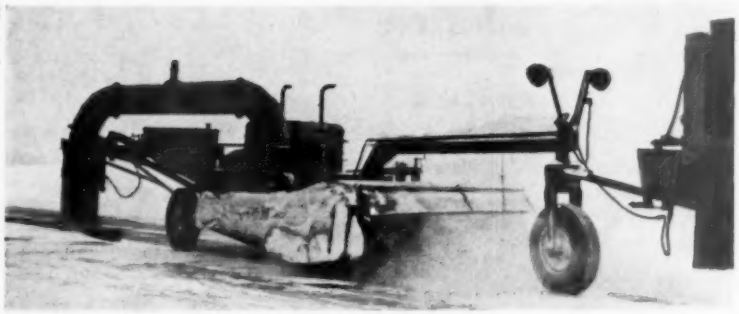
The companies participating in the venture are Elliott Brothers (London), Ltd., McMichael Radio, Ltd., Rank Cintel, Ltd., Southern Instruments (Contracts), Ltd., and W.S. Electronics, Ltd. The last named has been appointed to act on behalf of the consortium in negotiations with the various governments and other interested bodies.

With a line-of-sight range of more than 100 miles, the system handles a number of channels of aircraft flight instrumentation by a flexible combination of frequency and time multiplexing. The modulators, which receive inputs from their associated transducers, feed a crystal-controlled VHF or UHF transmitter.

A composite transmitted signal is accepted by a ground receiver which provides outputs in a variety of forms. These can be presented simultaneously as meter indications, chart recordings, and digitized outputs for feeding a computer.

In the simplest arrangement there are eight possible instrumentation channels, accepting signal frequencies up to 700 c/s. When time multiplexing is employed, six channels are retained independently and the frequency band of the other two channels is used to extend the system to cover 29 parameters. The time multiplex facility is divided into 24 time-shared channels by means of a 24-way rotary mechanical switch. Each channel has a duration of about 2 millisecs. repeated every 60 millisecs.

The receiver output signal can be recorded, together with associated information, on tape recording equipment with linear frequency response to 16 kc/s with stacked heads. One track carries the complete telemetry signals, whilst the second track carries speech from radio and inter-com and also carries a crystal-controlled 10 kc/s synchronizing signal for time reference.



AIRPORT CLEANER.—Mercury Airfield Equipment, Ltd., of Gloucester, have recently been appointed the U.K. distributors for Sicard Inc., of Canada, who manufacture this high-speed airport sweeper. In quantity production, this sweeper is used on both military and civil airfields in North America and Europe.

Index Available

The index to Vol. 98 (January-June, 1960) of THE AEROPLANE AND ASTRONAUTICS is now in print. Copies are available on receipt of 4d. to cover packing and postage. All applications should be addressed to Temple Press Limited, Bowling Green Lane, London, E.C.1.

Publications Received

Balloon, Flying-Machine, Helicopter. By Svante Stubelius. The second part of a study of the history of terms for aircraft in English (the first, "Airship, Aeroplane and Aircraft," was published in 1958). Covers the etymology of words in the Machine, Vehicle, Bird (Avis, Ornithopter and Kite), Balloon, Aerostat, Aerodyne, Dirigible, Blimp, Flying, Aerodrome, Glider and Helicopter groups, plus much other interesting material on aeronautical terms, and a bibliography and index covering both volumes. 410 pp.; 6¼ in. by 9¼ in. Almqvist and Wiksell (26 Gamla Brogatan, Stockholm C). Price Sw. kr. 35.

Sir Hubert Wilkins. By John Grierson. A biography of the Australian explorer, who was knighted for a flight across the Polar Basin from Alaska to Spitzbergen and became the first man to fly in Antarctica. Much little-known material is included, as well as an account of Wilkin's well-known attempt to sail the submarine "Nautilus" under the North Pole in 1931. 224 pp.; 5¾ in. by 8¾ in. Illustrated. Robert Hale, Ltd. Price 21s.

Aviation Calendar

Nov. 9

Hull.—R.Ae.S. Brough Branch 7th Sir George Caley Memorial lecture, "Forty Years of Aviation Writing," by Maj. Oliver Stewart, at the Royal Station Hotel, at 19.00 hrs.

Liverpool.—Institution of Production Engineers North Western Region lecture, "Aircraft Design," by F. F. Heaton, at the Stork Hotel, Queen's Square, at 19.30 hrs.

Nov. 12

Birmingham.—British Interplanetary Society Midlands Branch lecture, "Radio Communication with a Space Probe," by W. T. Blackband, in the Birmingham and Midland Institute Cinema, Paradise Street, at 18.30 hrs.

Nov. 15

Luton Airport.—R.Ae.S. Branch lecture, "Certification of Aircraft in the United States," by K. H. Greenly, in the Napier Senior Staff Canteen, at 18.00 hrs.

Nov. 16

London.—The Kronfeld Club Dunlop film, "Wheels on Air," and Rootes film, "The Rally Breed," at the Basement, 74 Eccleston Square, S.W.1.

Nov. 17

London.—G.A.P.A.N. Annual General Meeting.

Nov. 18

London.—The Institute of Navigation symposium held jointly with the British Interplanetary Society "Navigation for the Early Exploration of the Moon," at the Royal Geographical Society, 1 Kensington Gore, S.W.7, at 10.00 hrs.

Nov. 22

Farnborough.—British Institution of Radio Engineers Southern Section lecture, "Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," by J. S. Shayler, at Farnborough Technical College, at 19.00 hrs.

Nov. 23

Weybridge.—R.Ae.S. Branch lecture, "The Art of Developing Aero-engines," by A. C. Lovesey, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., at 18.00 hrs.

Glasgow.—R.Ae.S. Branch lecture by T. C. Cain, at the Engineering Building, Glasgow University, at 19.30 hrs.

London.—Kronfeld Club lecture, "The Sea and Sailing," by F. Gee and F. Irving, with slides, at the Basement, 74 Eccleston Square, S.W.1.

Cardiff.—British Institution of Radio Engineers South Wales Section lecture, "Radio Navigational Aids in Aircraft," at the Welsh College of Advanced Technology, at 18.30 hrs.

Company Notices

NEW COMPANIES

PANAVIA, LTD. (672,129).—Private co. Reg. Oct. 10. Cap. £100 in £1 shares. Sea and Air transport operators. Directors: George Fox, 39 Alsacerstrasse, Basle, Switzerland; Thomas D. Keegan, Ashton House, Steeple Ashton, nr. Trowbridge. Sec.: G. Fox. Sols.: H. Maxwell Lewis, Southend.

AIR RESCUE, LTD. (672,221).—Private co. Reg. Oct. 11. Cap. £100 in £1 shares. Air rescue and air ambulance for personnel; agents for aviation equipment, spares and replacements. Directors: Roy L. H. McDougall, 23 Dolphin Close, St. James Road, Surbiton, Surrey; Norman L. Fox, 53 Eltisey Avenue, Cambridge. Sec.: Marion McDougall. Reg. off.: Eagle House, 109 Jermyn Street, S.W.1.

PETER S. CLIFFORD AND CO., LTD. (672,264).—Private co. Reg. Oct. 11. Cap. £1,000 in £1 shares. Aviation consultants. Directors: Peter S. Clifford and Mrs. Joan L. Clifford, both of Tresa, Bletchington Road, Kirtlington, nr. Oxford.

New Patents

APPLICATIONS ACCEPTED

855,993.—**Sperry Gyroscope Co., Ltd.**—"Control apparatus for aircraft."—Oct. 31, 1958. (Nov. 22, 1957.)

856,153.—**Soc. d'Etudes et de Construction Electriques Mecaniques et Metallurgiques.**—"Towed aerial target."—Mar. 24, 1959. (Mar. 25, 1958.)

855,980.—**Douglas Aircraft, Inc.**—"Device for preventing ingestion of debris by gas turbine engines."—Sept. 23, 1958. (Sept. 26, 1957.)

856,090.—**English Electric Co., Ltd.**—"Hydraulic powered feel simulators for power-operated flying controls."—Apr. 10, 1959. (Apr. 18, 1958.)

856,445.—**Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.**—"Aircraft controls."—Mar. 4, 1958. (Mar. 8, 1957.)

856,122.—**Reiser, R.**—"Construction toy."—Feb. 4, 1959.

855,961.—**M.L. Aviation Co., Ltd.**—"Escape equipment for airmen."—Sept. 25, 1957. (Oct. 10, 1956.)

855,977.—**Helipara G.m.b.H.**—"Parachutes."—Jly. 4, 1958. (Jly. 6, 1957, and Nov. 28, 1957.)

855,982.—**Aerazur Constructions Aeronautiques.**—"Parachutes."—Oct. 6, 1958. (Oct. 7, 1957.)

856,119.—**Svenska Aeroplan A.B.**—"Protection device for occupant of aircraft ejection seat."—Oct. 16, 1958. (Feb. 5, 1958.)

856,483.—**Martin, J.**—"Seat adjusting mechanism." Apr. 30, 1959. (May 1, 1958.)

Printed specifications of the above will be available on Dec. 14, 1960, and the opposition period will expire on Mar. 14, 1961.

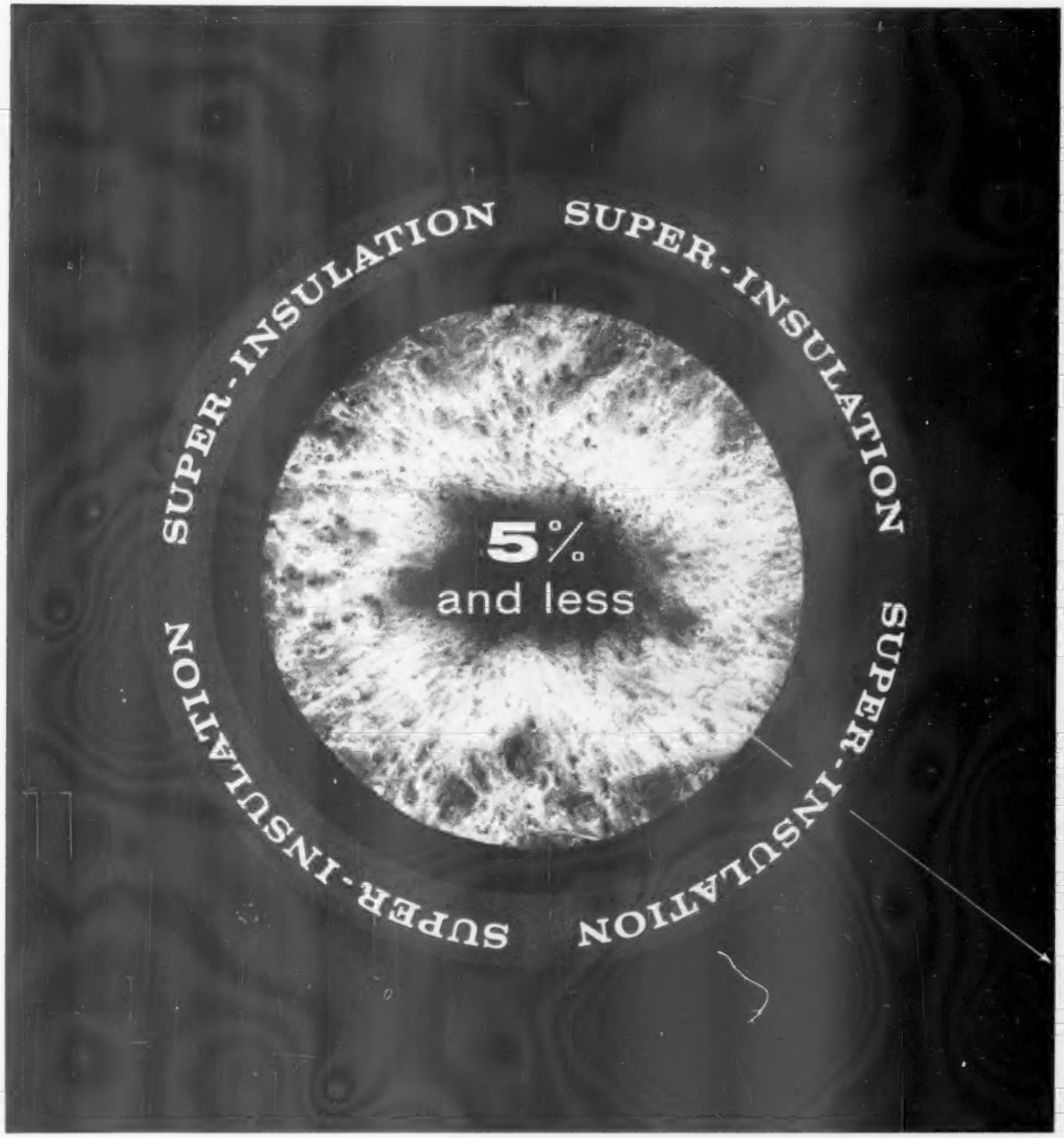
Personal Notices

BIRTHS

Fulton.—On Oct. 9, at St. Paul's Hospital, Hemel Hempstead, to Annemarie (*née* van Wijk), wife of Kenneth Fulton—a daughter.

Harper.—On Oct. 18, at Jerusalem, to Dorothy (*née* McLean), wife of Sqn. Ldr. V. H. Harper, H.M. Vice-Consul—a son.

Lindsay.—On Oct. 18, at the Old Cottage, North End, Newbury, to Hazel (*née* Johns), wife of Sqn. Ldr. I. R. Lindsay, R.A.F.M.S.—a son.



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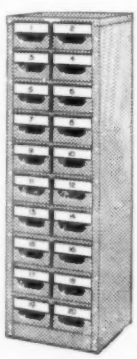

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THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM ORION AIRWAYS, LTD., OF GATWICK AIRPORT, HORLEY, SURREY, for the following Normal Scheduled Services initially with Viking aircraft and later also with Viscount aircraft for the carriage of passengers, supplementary freight and mail:—

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APPLICATION NO. 4527 between Coventry and Dublin at an initial frequency of five return flights weekly increasing later to 10 return flights weekly for seven years from January 1, 1961.

FROM OVERSEAS AVIATION (C.I.), LTD., OF 6 YORK STREET, ST. HELIER, JERSEY, C.I. for the following seasonal Normal Scheduled Services with Argonaut and Ambassador aircraft, for the carriage of passengers and supplementary freight, at an initial frequency of two return flights weekly on each service, increasing later in accordance with traffic demand from April to October each year, for seven years from the date of approval:—

APPLICATION NO. 4532 on the route Jersey-Frankfurt-Munich.

APPLICATION NO. 4533 on the route Jersey-Amsterdam-Hamburg-Copenhagen.

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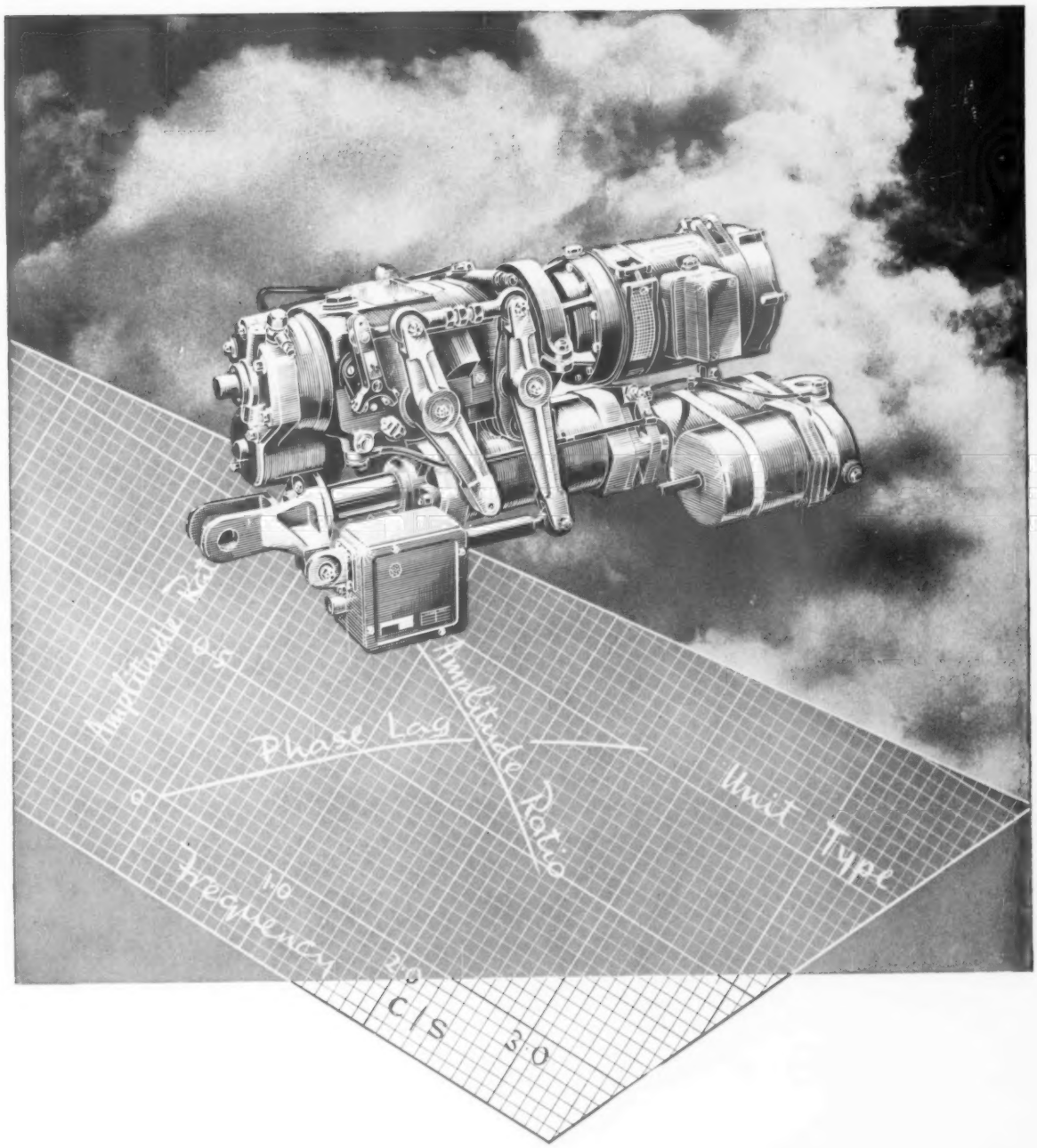

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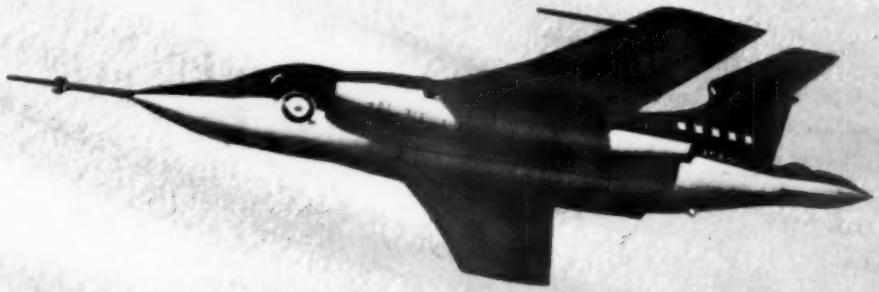

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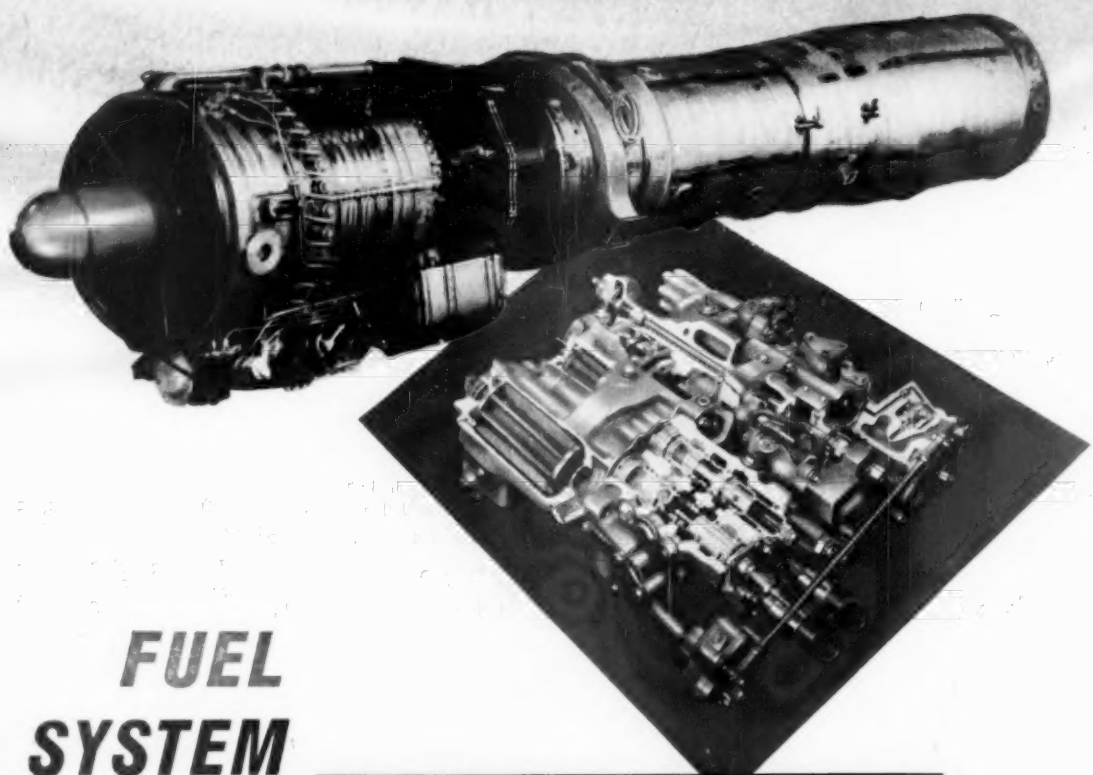

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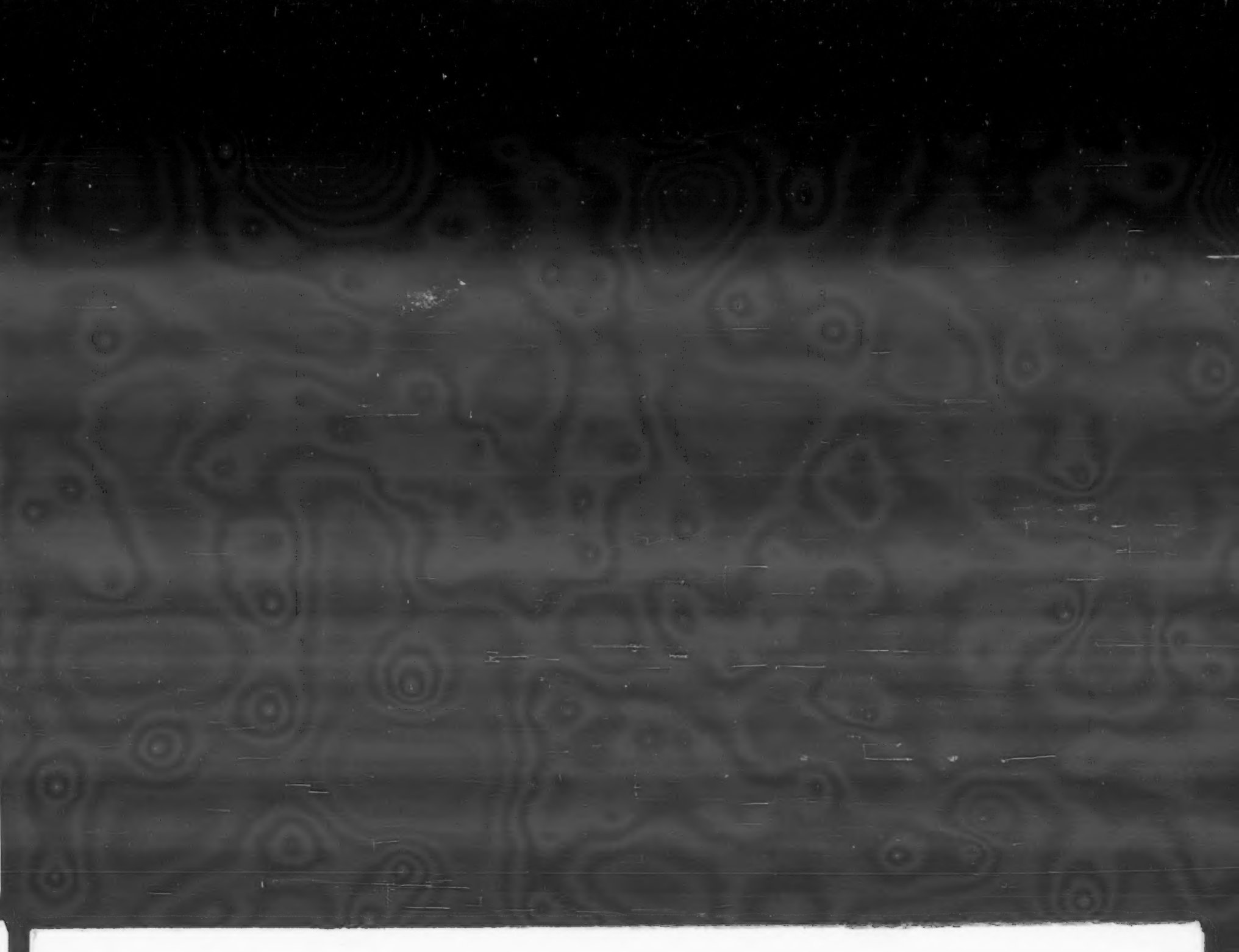
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